TOOLING UP FOR DEFENSE NUMBER

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AVIATION

The Oldest American Aeronautical Magazine

Twin Wasps FOR PAN AMERICAN'S NEW DC-3's

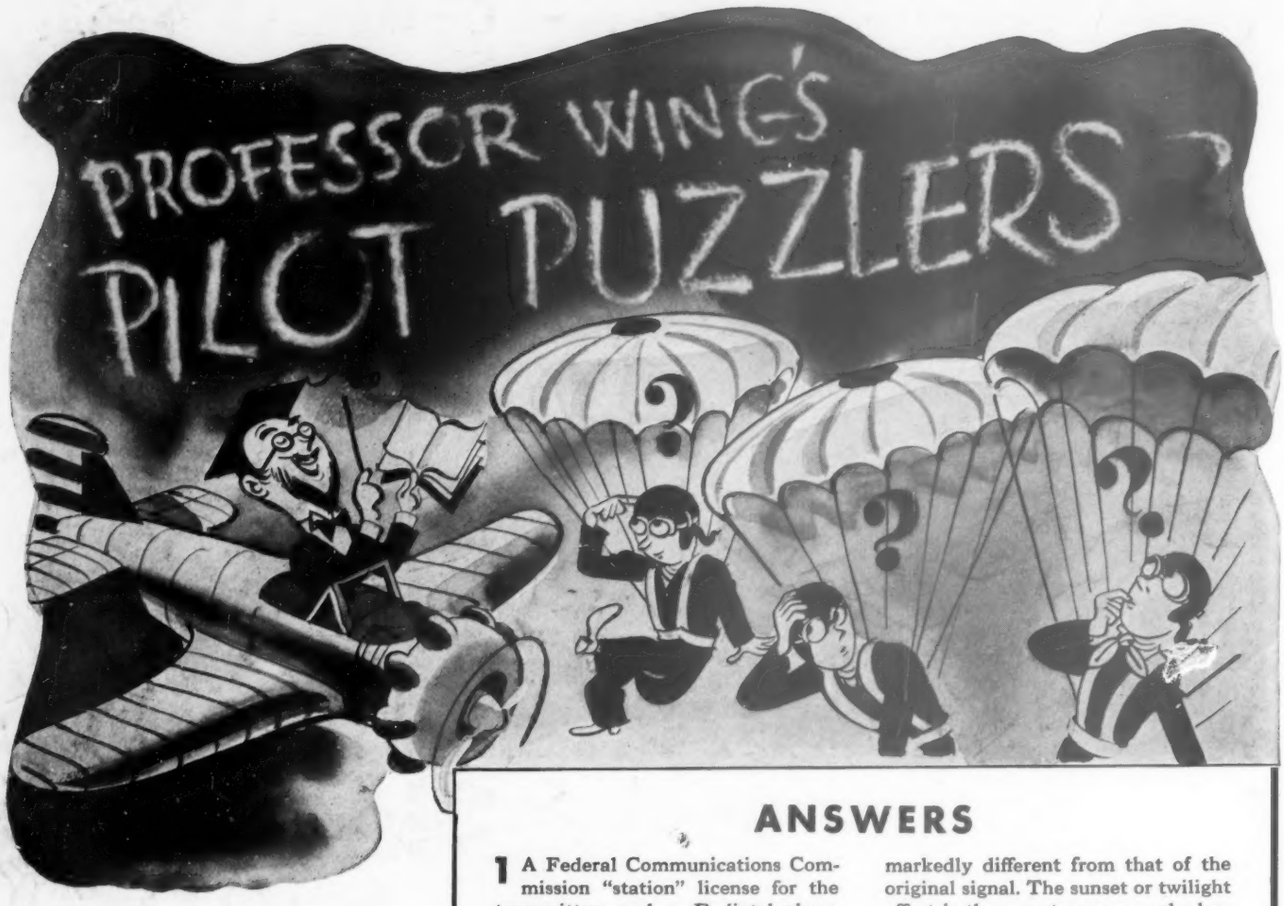
As an important part of its forward-looking program for speeding up service between the Americas, thirteen new DC-3's will soon go into service over the inter-American routes of the Pan American Airways System.

In selecting Twin Wasps to power these additions to its fleet, Pan American reflects the world-wide recognition of the dependability of Pratt & Whitney engines.

PRATT & WHITNEY AIRCRAFT

One of the three divisions of

UNITED AIRCRAFT CORPORATION



1. What licenses are required for the operation of an aircraft transmitter equipped for voice transmission only?

2. Are detonation and pre-ignition the same?

3. What is sunset effect?

4. Why is lead tetraethyl added to gasoline?

5. What is a line squall?

6. What advantage can be obtained by the use of 100 octane fuel over 87 octane?

SHELL engineers have developed a gasoline that gives you better all-round performance—quicker starting, more "revs" during the take-off and climb, as well as lower fuel consumption. The answer is that Shell Aviation Gasoline is a balanced fuel!

Why not follow the lead of experienced pilots in commercial and private flying and switch to Shell Aviation Gasoline today?

Just call or write Shell Aviation Department, 50 West 50th Street, New York City; Shell Building, San Francisco; Shell Building, St. Louis.

ANSWERS

1 A Federal Communications Commission "station" license for the transmitter, and a Radiotelephone Operator's License, third class, for the operator.

2 No. Detonation and pre-ignition are not the same. Detonation is a phenomenon related to an instantaneous combustion of part of the fuel in the combustion chamber. Detonation may be controlled by the octane number or antiknock value of the gasoline or by the design of the combustion chamber and of the engine itself. As the term implies, pre-ignition is ignition of the gasoline mixture before the spark occurs at the engine's spark plugs. Pre-ignition is usually caused by local hot spots in the combustion chamber.

3 The "sunset" or "twilight" effect is the change noticeable in radio-compass bearings taken at the time of sunset or early twilight. The variation is not consistent and may be as much as 50 degrees. The rapid change in the intensity of the sun's rays on the earth's atmosphere warps or distorts the "Heaviside layer" in regions of sunrise or sunset. Radio signal waves reflected from the distorted portion of the "Heaviside layer" are bent abnormally, frequently so that the direction of the reflected wave is markedly different from that of the original signal. The sunset or twilight effect is thus most pronounced when the radio signal passes through the sunset or sunrise, *i. e.*, when the sunset or sunrise is between the receiving and sending stations.

4 Lead tetraethyl or ethyl fluid is added in specified quantities to increase the octane number or antiknock value of gasolines.

5 A line squall is a more or less unbroken line of squalls and thunderstorms traveling across the country, generally accompanied by a sudden brief flash of wind somewhat stronger and longer than a gust. It generally occurs with the passing of a trough line, *i. e.*, when the barometer stops falling and commences to rise. When the trough passes, the wind shifts rapidly with a violent gust after which the temperature falls quickly, accompanied by a shower of rain or hail and often thunder and lightning. The wind may rise from a calm to 70 or 80 miles per hour in less than a minute.

6 In engines especially designed for the use of 100 octane fuel, about 25% more power can be developed or the specific fuel consumption can be reduced about 12%.

SHELL

AVIATION PRODUCTS

Picked Up Along Editorial Airways

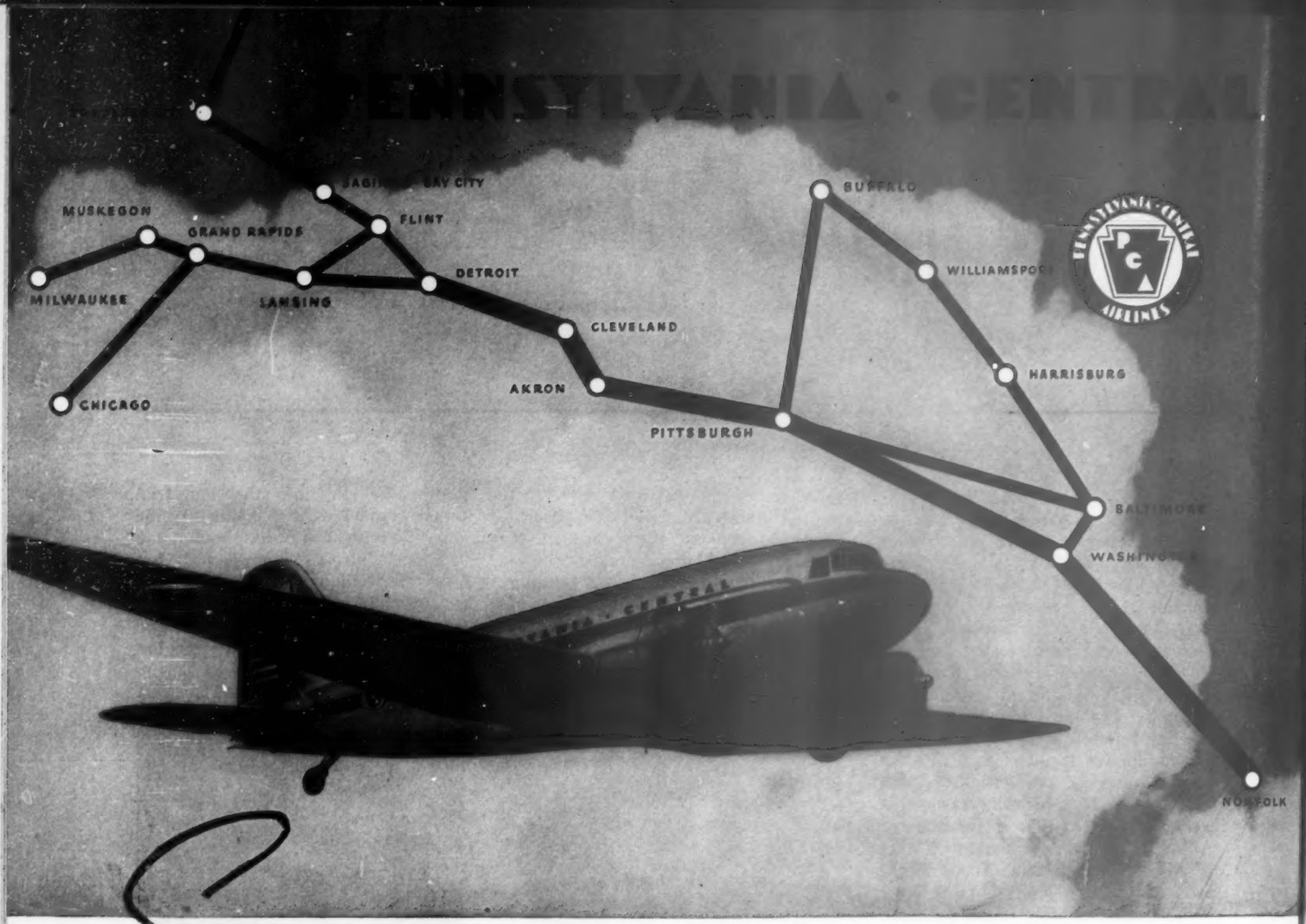
» PRODUCTION, and more production is the keynote in the aircraft industry today. As we pointed out last January ("Box Score") large scale production is the most important element in the measure of air power today. It has taken us in the United States a long time to realize how far we have lagged certain European nations in the matter of aircraft production. But the tide has turned. We are now engaged in building up our productive facilities at a rate far beyond anyone's expectations several years back. It is for that reason that we have devoted this entire issue of AVIATION to an examination of what is going on in certain of our larger producing plants—in tooling up for national air defense. It has been impossible to cover every plant in the country—not only would it have been difficult to find enough space to treat them adequately, but also in some cases there were excellent reasons why the production story could not be told at this time. Although the present review is not comprehensive, we hope that as time goes on it will be possible to bring to the readers of AVIATION, the detailed story of the tools and equipment of most of those other outstanding manufacturing plants that are not covered in the present case. For those in the aircraft industry who are now engaged in expanding their plants and tooling, a classified directory of machine tools and other production equipment manufacturers has been included in this issue. An effort has been made to include in this listing all those companies that are manufacturing important equipment for the airplane and engine builders. Although our research has been extensive, it is not impossible under the circumstances that some have been missed. We would welcome any additions or corrections to our published listing from any source.

» ALL QUIET (at least relatively) on Europe's belligerent air fronts. Continual reports come through of minor raiding and reconaissance, also of a certain amount of dog fighting over the western front. So far (again with reservations because anything can happen at any time now) neither side has attempted serious large scale raiding by air into the industrial areas. We heard Al Williams say the other night that this has been not a "phoney" but a "funny" war. It hasn't been funny, of course, for the relatively few individuals that have gotten in the way of machine gun bullets or archie bursts, but it has certainly not developed so far along

AWARDEES OF THE MONTH: The month of November was marked by announcement of the winners of two of Aviation's most important annual awards, the Collier Trophy "For the Greatest Achievement in Aviation in America" during the year 1938, and the Daniel Guggenheim Medal for "Outstanding Contribution to the Design and Construction of Transport Airplanes."

HOWARD HUGHES, whose flight in mid-1938 involving "notable advances in aerial navigation, communication and engineering; demonstrated the value of organization and planning in long range aircraft operation and afforded a world-wide demonstration of the superiority of American aviation products and techniques" won for him the 1938 Collier Trophy. In accepting the award he said "the purpose of this trophy is to recognize engineering progress and . . . and I am sure it was really intended not only for the five of us who were in the plane but for the thousands of others who built it."

DONALD WILLS DOUGLAS, 1939 Guggenheim medalist, needs little introduction to Aviation readers. At 47, he is one of the leading Aviation figures in the world, president of Douglas Aircraft of Santa Monica, Calif. He was a graduate of Massachusetts Institute of Technology, Class of 1914. In 1936 he won the Collier award for the early developments of the Transport Type which is again recognized by the Guggenheim award. Presentation will be made at the Honors Night Banquet of the Institute of the Aeronautical Sciences in New York on January 26, 1940. He was President of IAeS in 1935.



Selects WRIGHT CYCLONES FOR THE "CAPITAL FLEET"

Early in 1940 another air line will turn to Wright Cyclone-powered equipment when Pennsylvania-Central's "Capital Fleet" of Douglas DC-3's is put into operation on its key route, serving the capitals of industry between Detroit and Norfolk with intermediate stops at Cleveland, Akron, Pittsburgh and Washington.

Pennsylvania-Central's new 21-passenger transports will increase their seating capacity 100% to meet their steady growth of traffic volume. The ships are each powered by two 1100-H.P. Wright Cyclone Engines.

IT PAYS TO FLY

Distinctively styled inside and out, these new 21-passenger airliners afford new luxury in air travel accommodations. Furthermore, new methods of sound-proofing make them quiet to an unprecedented degree.

The adoption of Wright Cyclones by this progressive air line marks another step in the trend which maintains the Wright Cyclone as the outstanding power equipment of leading air lines throughout the world.

WRIGHT AERONAUTICAL CORPORATION
Paterson *New Jersey*
A Division of Curtiss-Wright Corporation

WRIGHT *Aircraft* ENGINES

the pattern imagined by most of us who have given considerable thought to air war and the uses of air power.

» BEHIND THE LINES, however, work has been going forward at a feverish pace in preparation for the actual outbreak of the real war in the air. Although it has been impossible to do much accurate checking under the circumstances, it seems not unlikely that Great Britain has pushed aircraft production up close to top capacity. We doubt, however, if the present pressure exceeds that which was exerted during the Spring and Summer when everything was in high gear. Taking into account a number of factors, it seems likely that output has been pushed beyond the figures claimed for Summer. Our own guess was that by early Fall British factories were turning out approximately 1,000 units per month, and by now maybe pushing along toward the 1200 machines per month level.

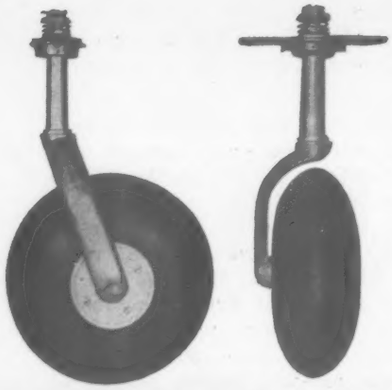
Under pressure of actual war there is little doubt also but that France is beginning to pull herself out of the production slough in which she found herself last year. Again, actual figures are lacking, but the probabilities are that French output may be approaching 400 units per month toward year's end. Between them it seems likely that French and British factories are putting 1600 to 1700 completed airplanes on the line every month.

» IN THE MEANTIME, it is a fair assumption that German aircraft factories have not been idle. Based on observations made in Germany in recent years and cross checking with other available information, it seems likely that German output could easily be double the average production estimates for last year, that it would not seem impossible that German factories are turning out aircraft at the rate of about 2,000 units per month at the present time. Factories such as the great Heinkel plant at Oranienburg, Henschel's near Berlin and Junker's at Dessau that were idling along on a one-shift per day basis when your editor visited Germany last Fall are now doubtless in full production. Generally speaking, shifting an aircraft manufacturing operation from one to three shifts per day does not triple the production, nor can three times the number of employees be worked efficiently. At this stage it may be reasonable to assume that the German aircraft industry has gone on a three-shifts per day basis, but that the personnel employed has been not much more than doubled, and that the output has been about doubled. This sort of reasoning yields about a 400,000 figure for personnel now engaged in the industry, and also the approximate 2,000-plane-per-month output estimated above. The question of the moment is, however, can Germany stand this pace indefinitely, or will she soon reach the end of her material resources, at least as far as aviation materials are concerned? Some informed observers say one year at the most. That is one of those questions which must at the moment remain unanswered.

IT PAYS TO FLY

» BEST EFFORT, so far, to answer questions concerning Germany's (and the Allies') staying power in the current conflict is in "Handbook of the War" by deWilde, Popper and Clark, and just published by Houghton Mifflin Co. It is a joint effort of the *Time-Life-Fortune* group and the Foreign Policy Association to round up the whole problem of causes, strategy, tactics and probable trends. The authors deal intelligently with the complicated problems of armies, navies and air forces, and, more important,—they have made extensive studies of the economic background of the belligerents to determine their sources of supply for essential materials, and their ability to transport such materials to the places they are to be used. How the war is to be paid for, and by whom, comes in for its share of attention. By and large, the German Reich comes out of this searching examination not too badly, a thought that may well give pause to those who are expecting a quick and easy termination of the struggle. The next-to-last chapter on Propaganda should be required reading for every American citizen.

"Maguire says we can't be too careful these days!"



Why your Landing Gear source ought to be Bendix

When you call in Bendix on a landing gear application your problem has been put into safe hands. While the particular specifications which result may be new, the basic job is thoroughly familiar. Here at Bendix, we know, from a dozen years' specialized experience, precisely what has to be done... also what has to be avoided, *and how to avoid it.*

Every factor affecting the production of your work at Bendix is very carefully controlled. The design, the dimensioning, the precision machining, are rigidly checked, of course; but back of and beyond all this, the strictest metallurgical control is maintained over every unit in every assembly.

So, quite apart from any considerations of preference or patents or price or proximity, if your landing gear source is Bendix, your landing gear satisfaction is sure.

BENDIX PRODUCTS DIVISION
of Bendix Aviation Corporation, South Bend, Indiana

Bendix

LANDING-GEAR EQUIPMENT

AIRPLANE WHEELS, BRAKES, PNEUDRAULIC SHOCK STRUTS, TAIL KNUCKLE ASSEMBLIES, PILOT SEATS

Side Slips

By
ROBERT OSBORN

» MR. THEODORE HALSIG, a former blacksmith in Detroit, has offered for Mr. Henry Ford's collection a Louis XIV carriage which was left at his shop for repairs sixty years ago. The carriage represented the last word in coach construction when it was built in 1835 and, according to the *Detroit Free Press* description, "is equipped with steps that drop automatically when the doors open."

How many of you aeronautical engineers thought that idea was original with you when you first worked it out for use on an airplane?

» A TOUR through Mr. Ford's Greenfield Village and a study of his collection of antiques would be good for the soul of any aeronautical engineer. In some of the old farm implements and old machinery, in wooden gears and hand-forged levers, he will find many of the bright ideas which he probably thinks were born in the 20th century. We speak from experience as we were startled to see, on a hundred-year-old stage coach, a detachable back rest which is now used on a Navy observation plane.

» THE "OLD BOYS" certainly knew a thing or two about engineering and,

logically enough, the old-time farm machinery seems to show the greatest ingenuity, as the isolated farmer of the past had to depend on himself and the nearest blacksmith for his labor-saving machinery. We used to have the pleasure of working with one of the best of this country's airplane designers, and he would generally say, as he started a sketch, "I saw something on a reaper-and-binder once that will solve this problem right nicely."

» THE FORMAL DEDICATION of North Beach airport in New York City went off in fine style, with Amon Carter standing directly behind the speaker's stand (probably with his six-guns unlimbered) to make sure that none of the speakers said anything which might detract from the shining glory of Fort Worth. Mayor LaGuardia had even abandoned his black sombrero in favor of one of Mr. Carter's famous ten-gallon gift variety.

Speaking of hats, it was regrettable that Grover Whalen was unable to be present at such a big event—at least we assume he was not present as the N. Y. *Times* stated "there was not a high hat within a mile of the speaker's platform."

» THE *Times* ALSO REPORTED that "Colonel Somervell, in his brief address presenting the airport to the city, declared with pride that the airport and the World's Fair were the 'two fastest moving large construction jjobjjsj jin this city.'"

You can't blame the typesetter—he probably had a mental picture of the men working on those speedy W.P.A. jjobjjsj.

» DR. JOHN T. MACDONALD, flight surgeon for Pan-American Airways, stated before a Medical Association meeting in Hollywood that flying is developing healthier men. He is quoted as saying that: "Tests have shown that air transport pilots with a million miles of flying to their credit are actually in better physical condition than when they began their careers. They see better (in some cases their eyesight is 20 percent above normal), their hearts and lungs are sounder, they possess greater emotional stability and they have 15 percent more red blood. A great deal of it has resulted from a system of living developed by the pilots. Improvements resulting from the self-disciplinary conditioning methods, however, may extend to the next generation. Children of veteran pilots are likely to inherit keener eyes and minds and a better sense of balance than the offspring of average men."

Now there's a man who's really doing his bit toward getting pilots back on their proper romantic basis with the public in general and the fair sex in particular. You'll remember we've been complaining bitterly for years about the people who were stripping the romance away from flying—orders to Army pilots to remove false teeth before flights, designing of fertilizer-spreading planes, but Dr. MacDonald is the first man to have responded to our clear clarion call.

» *Detroit Free Press* headline: **"AGE OF GLORIOUS IDLENESS IS NEAR, SAVANTS BELIEVE"**, referring to the

statements made by assembled leaders of science, industry and education at the dedication of KDKA's new radio station in Pittsburgh.

Considering the state of the aviation industry when the business boom of the last war was over, the headline might be good advice for the thousands of people in this airplane business now. In other words—put it away while you're getting it!

» A NEWS ITEM states that another attempt to deliver mail by means of a rocket ended in disaster, this most recent experiment having been tried out in Cuba.

Once again we'd like to ask our friends who wish to write us to continue using regular air mail for the time being.

"AVIATIONS LEAD LATE RALLY"
"AVIATION BLUE CHIPS LEAD ADVANCE."
"AIRCRAFTS DOMINATE WHIRLWIND SESSION IN STOCK MARKET"
Financial Page Headlines

My! My! Who remembers the days not so very long ago when aeronautical stocks had to eat out in the kitchen with the hired man and the maid-of-all-work?

★ ★ ★ ★ ★ AVIATION *for*

"The building up of early and a large scale munitions production capacity by the American industry and the continuous operation of the necessary manufacturing facilities is of vital importance to National Defense. To obtain this end, the War and Navy Departments reserve the right to control, in accord-

Charles Edison,
Acting Secretary of the Navy

The NAVY

"It is desired to point out that expansions of production facilities for aeronautical equipment in America, to which this Policy particularly applies, are paramount in the interest of National De-

Rear Admiral J. H. Towers,
Chief, Bureau of Aeronautics
Aeronautical Board

AMERICA FIRST!

THE TWO QUOTATIONS ABOVE refer to the recently revised policy of the War and Navy Departments covering the release of aircraft, aircraft engines, and items of aircraft equipment and accessories for export and domestic sale as drafted by the joint A-N Aeronautical Board on 28 September and issued on 5 October. They are a part of the introduction to a document that deserves a careful reading by everyone connected with this industry.

As with most other regulatory measures promulgated in wartime or under conditions of unusual stress, it has evoked some loud squawks of protest. Some see in its provision for inspection and approval of equipment for export nothing but additional annoyance and delay in increased red-tape and paper-work. Others are taking a gloomier view. They claim to see the hand of government restriction reaching out to interfere with their right to sell their products to whomever and whenever they please. The most pessimistic go even further and see the shadow of absolute government control, if not of out and out government ownership, creeping up on the aviation industry.

After reviewing the situation, however, we cannot see that any such extreme view is justified at this time.

ance with the provisions of this Release Policy, the release of information pertaining to all types of aeronautical equipment which may have a military value and which information is intended for negotiation purposes to manufacture, sell, or export at a future date to sources other than the War and Navy Departments."

Harry H. Woodring,
Secretary of War

The ARMY

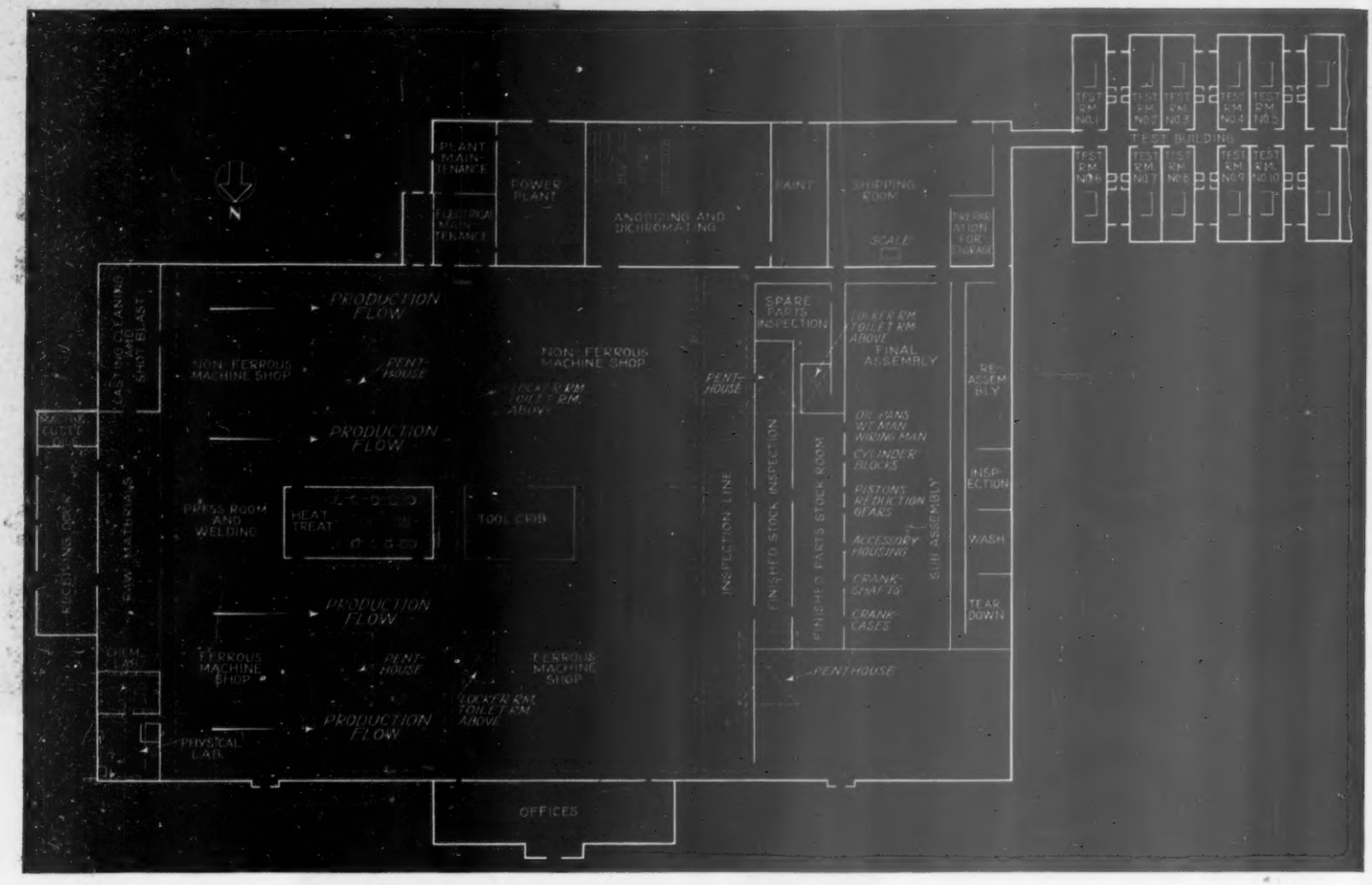
fense. However, deliveries of equipment being manufactured, or to be manufactured for the U. S. Government will not be interrupted in order to produce aeronautical equipment for other customers."

Maj. Gen. H. H. Arnold,
Chief of the Air Corps
Aeronautical Board

There is no doubt about the additional red tape and probability of delay in making shipments while government inspectors decided whether this or that gadget can qualify under the release policy. But while putting up with such annoyances, it will do well to keep in mind the real intent of the War and Navy Departments in the whole matter.

Never before has this government offered so much encouragement for the selling of up to date aircraft abroad. Under former restrictive measures, it was often necessary to wait as much as two full years before release could be obtained for export on articles of interest to the Army or Navy. Under the new policy that has been scaled down to the extent that it is now possible for manufacturers to offer in foreign markets thoroughly modern design in military aircraft and engines.

Chief concern of the Aeronautical Board has been to preserve one fundamental principle,—that our own interests be protected above all else. The new release policy is intended as a form of insurance that will guarantee, first, that the sale of aircraft to belligerents abroad must not interfere with the requirements of our own national defense program, and second, that manufacturers must guarantee that our own people must have first access to the fruits of America's ingenuity. If everyone on the industrial front keeps firmly in mind the principle of AMERICA FIRST, there should be no danger of undue interference on the part of the government in anyone's private dealings with outside customers. What the industry must do is to impose a certain amount of self discipline on itself. It must police itself by common consent if it is to escape policing and final control by outsiders.



New Allison Plant is

NO TOPSY

It was Built from the Beginning for Fixed Capacity

Although the New Allison Plant may seem extravagant at first sight, the ingenuity of its design has done much to offset the added expense of construction and operation in the long run. Intensive use may easily make it more economical than one derived by mushroom growth.

By Leslie E. Neville
Managing Editor of AVIATION

NOT FAR from the famed Indianapolis Speedway is rising an aircraft engine manufacturing plant that did not grow like Topsy but was designed from the beginning as a factory dedicated to the production of the V-1710 engine which was developed by Allison in cooperation with the Materiel Division of the Army Air Corps. Behind the project were the high quality manufacturing technique developed over a long period by Allison and the wide resources and production experience of the General Motors Corporation. These elements were neatly fused by the able generalship of O. T. Kreusser, General Manager of the Allison Division.

Unlike other engine plants, Allison's Unit 3 was built for a given production capacity for the eight variations of a single basic design. Physical expansion of the present unit is possible up to one hundred per cent by extension of the central portion of the building. Further expansion must take the form of separate units in multiples of the first.

There are many advantages laborwise in the fresh water location of Indianapolis but there is one major disadvantage. It is the heat and humidity of July and August. Not only is it difficult to maintain workers' efficiency during the muggy period, but some chemical constituent in the workers' perspiration induces rusting of the ferrous parts they handle in spite of the grease coating usually found on machine shop products. This was hard to believe until General Man-

Looking up into one of the four penthouses wh
the air conditioning equipment is installed. N
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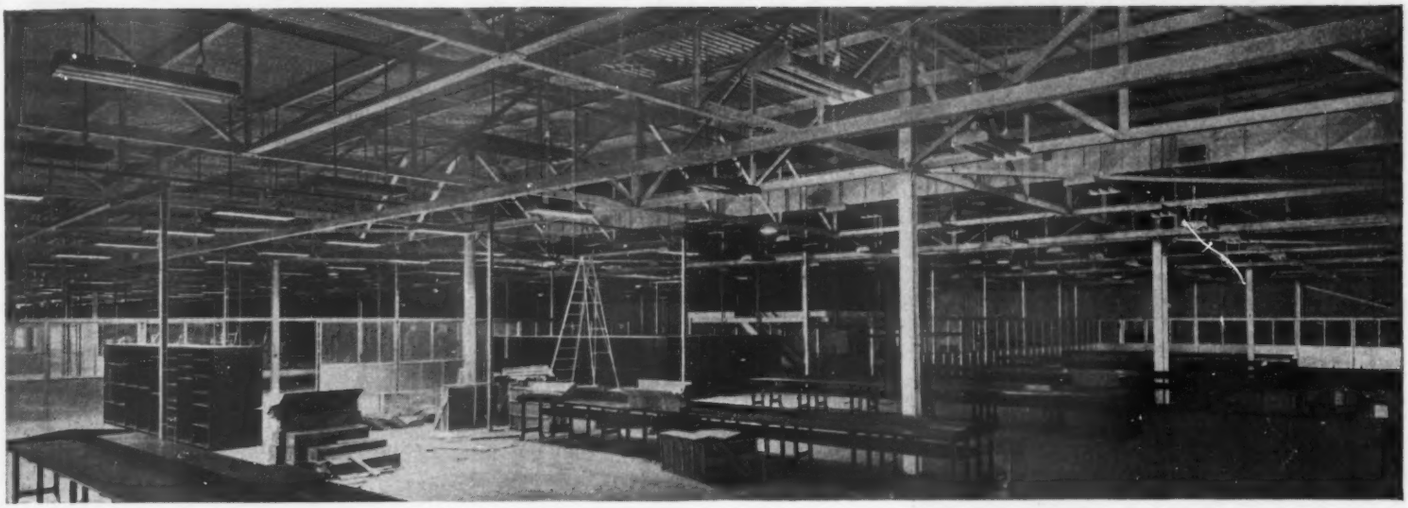
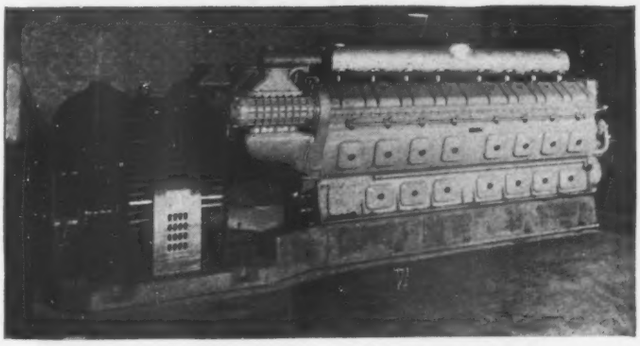
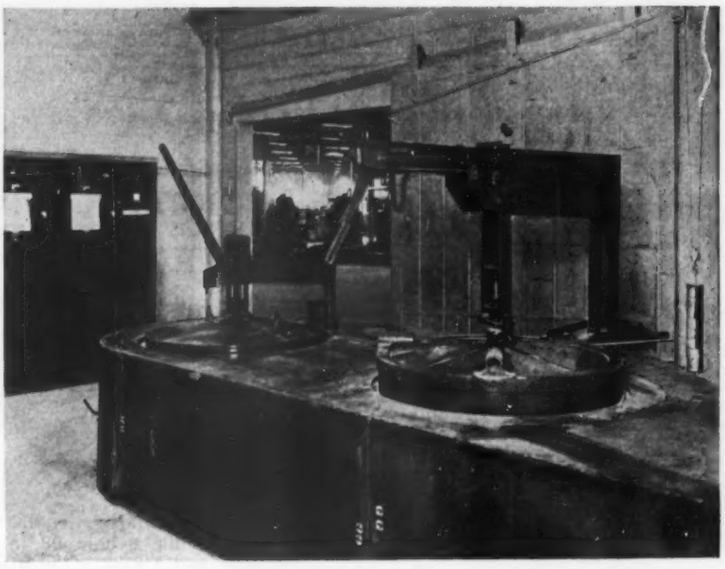




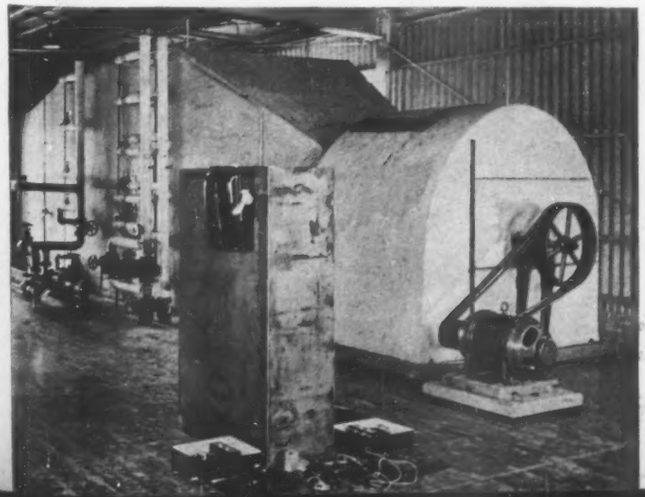
Above: One of the diesel units of the power plant. The electrical unit may be used as a generator for power or as a motor to drive the air conditioning compressors.

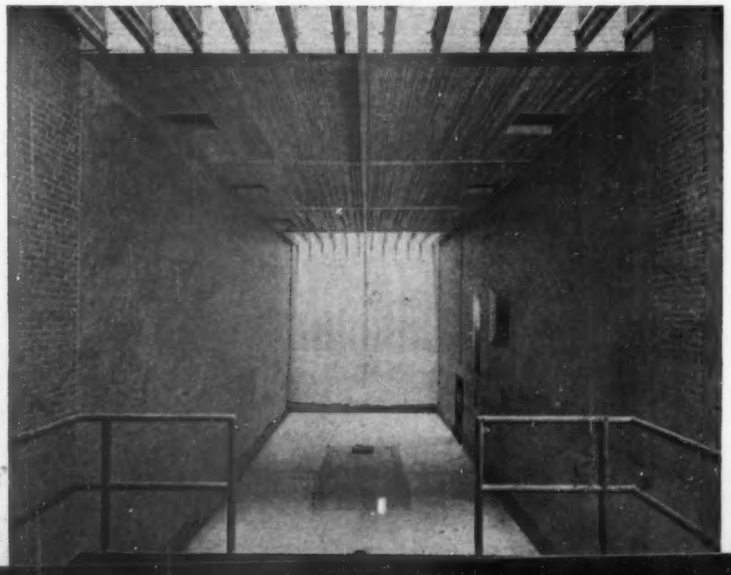


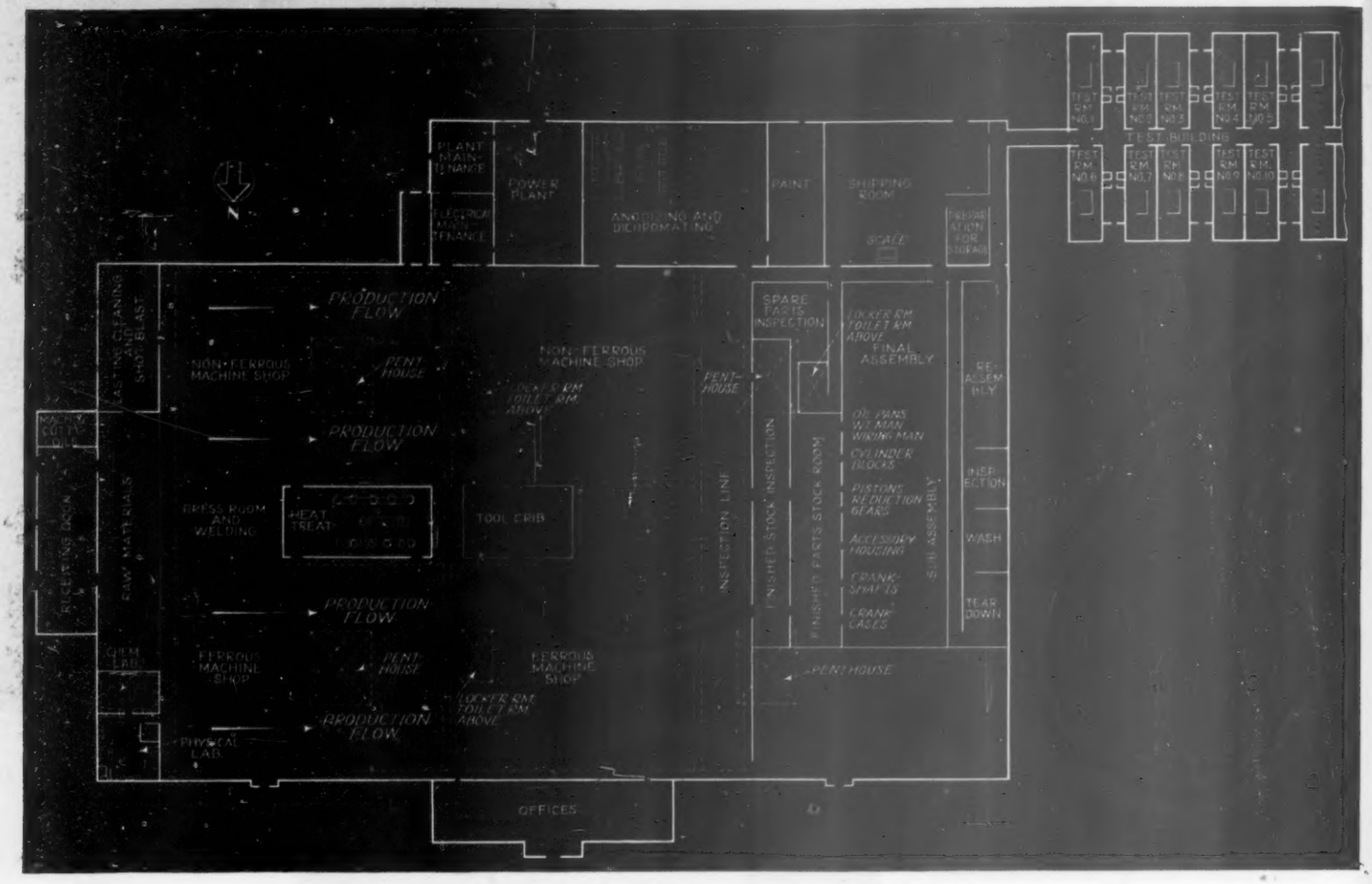
Right: A corner of the heat treating department. Furnaces are sunken into the floor, making them waist high for ease of operation. The control board (left) is visible from all parts of the room.

Lower Right: An engine test cell before the installation of equipment. These cells are soundproofed and heavily reinforced in the plane of the propeller discs.

Below: One of the air conditioning units in penthouses.







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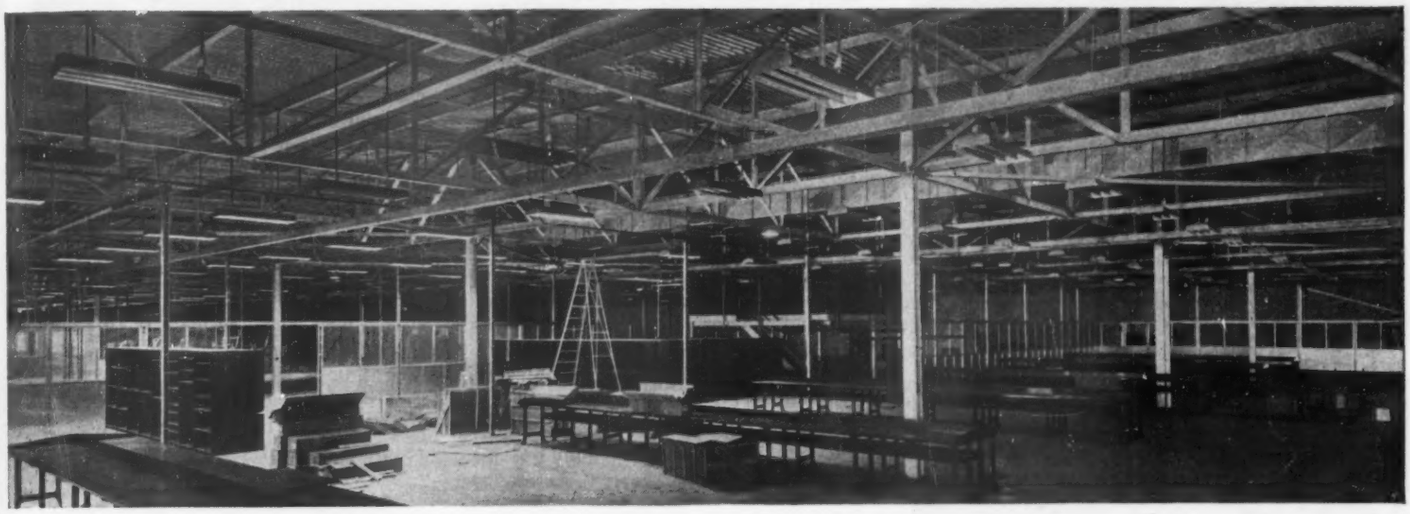
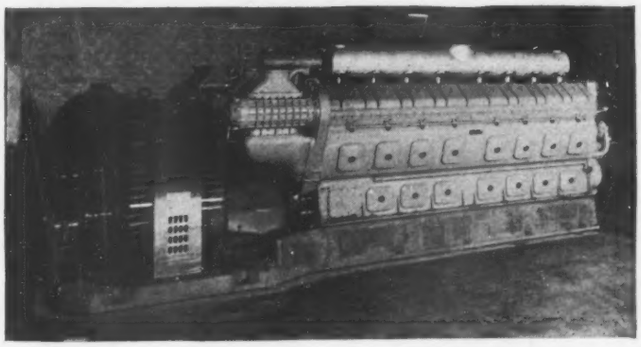
Looking up into one of the four penthouses where the air conditioning equipment is installed. Note fluorescent lighting units and air duct at left.

Portion of the assembly department. Machined parts move into the stock bins at the rear and are requisitioned for use by the assembly department.





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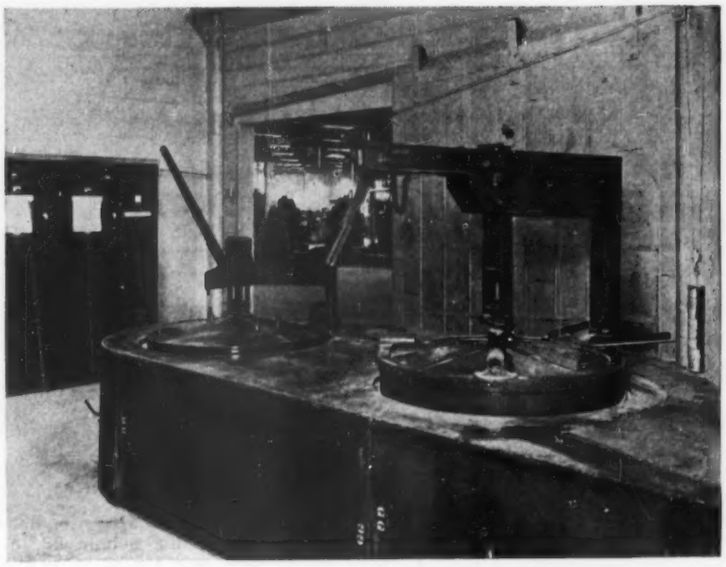
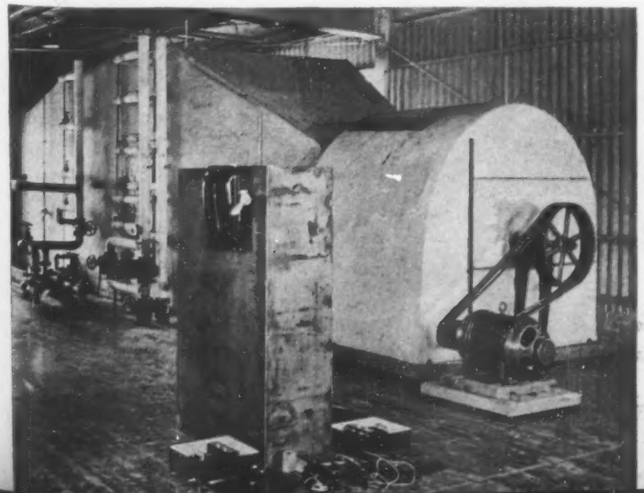
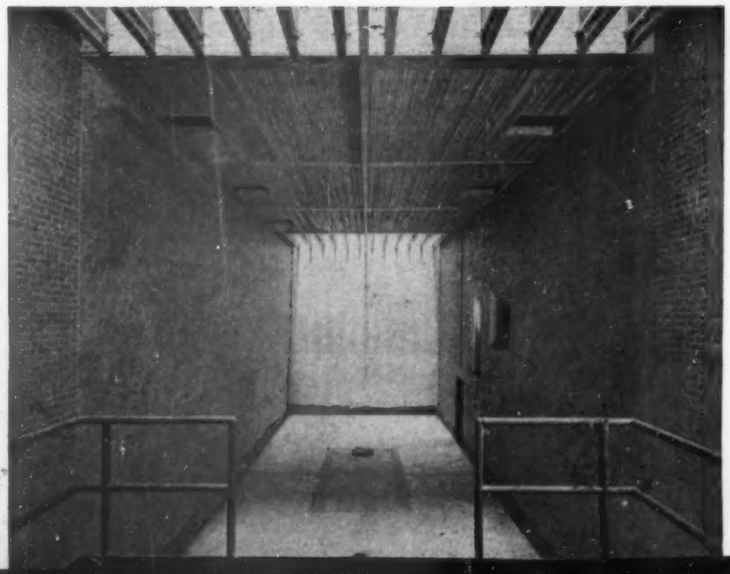
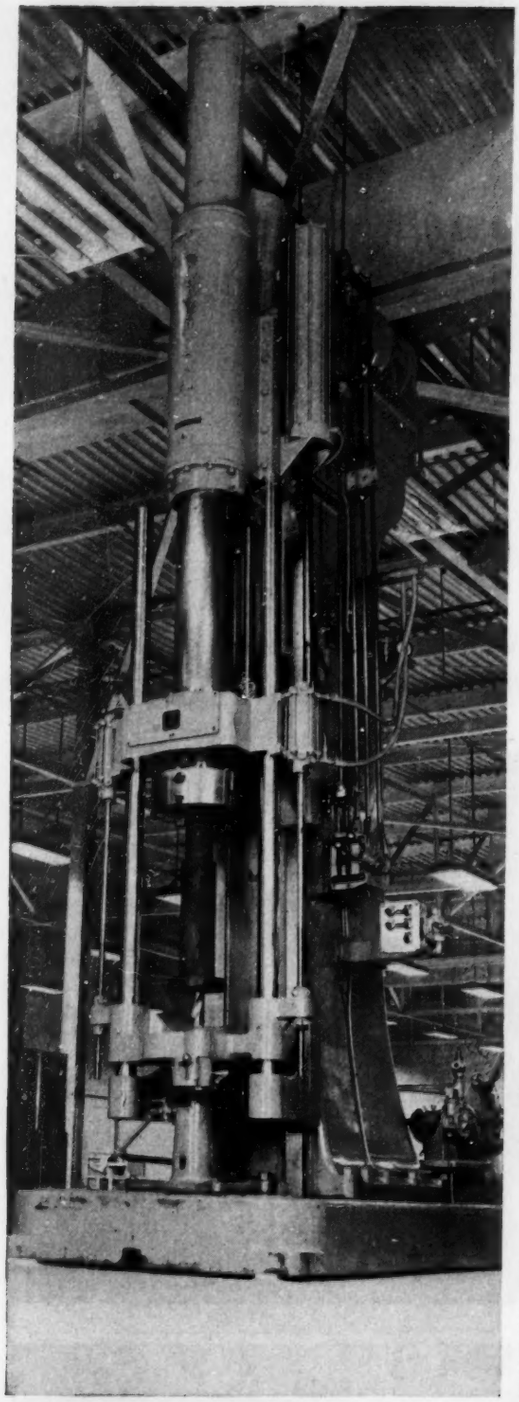
Below: One of the air conditioning units in penthouses.









This Barnes Hydram H-4 drills a hole 28 in. deep and 4 5/32 in. in diameter at one pass. The forging rotates in the chuck while the twist drill is fixed in vertical position. Oil is fed under pressure to the drill.

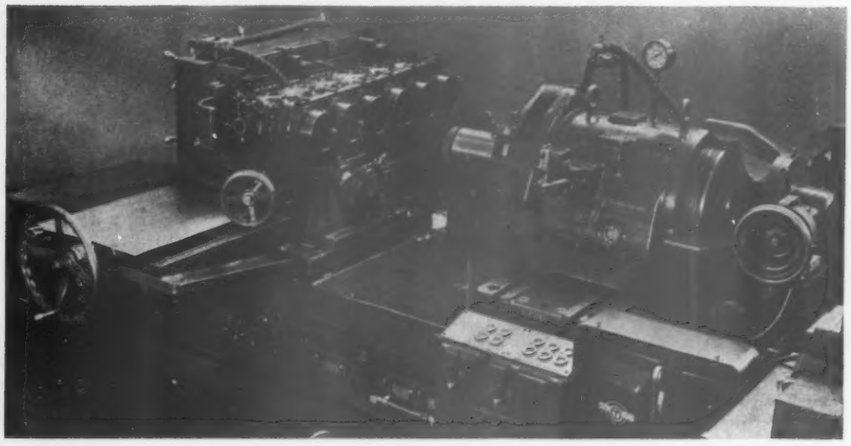
ager Kreusser showed us finger marks in rust on a brightly finished machine part. This condition plus the loss in efficiency in the muggy months led to the decision to resort to air conditioning. And here the long and varied refrigeration experience of General Motors proved very helpful.

Year around air conditioning demanded a windowless building and that, combined with the prospect of three shift operation, dictated artificial lighting. The result was a highly successful installation of Westinghouse Fluorescent Industrial Lighting Units.

Even the air conditioning system is highly original in design. Previously it was customary for buildings of this type to install systems consisting of fans, filters and separate coils for heating and cooling. In this system it was forecast statistically that, if complete evaporation could be accomplished, evaporative cooling could be used without using refrigeration during a large part of the time. A capillary air conditioner which would both clean and saturate the air at the wet bulb condition of the air entering the capillary was selected. Eight of these units, each capable of handling 52,000 cu. ft. of air per minute, were installed in four penthouses on the roof.

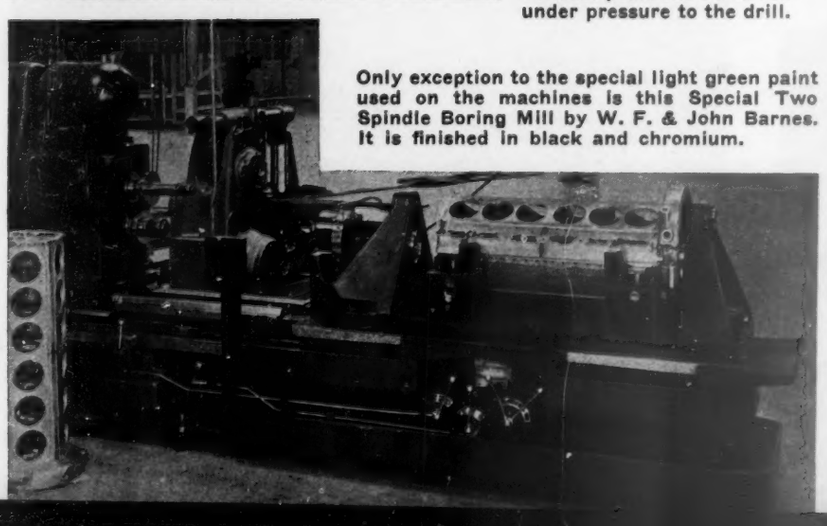
Substantial power saving is effected by the small volume and low pressure of water required. For simple humidification and evaporative cooling, each cell requires 2½ gal. of water distributed at 6 lb. nozzle pressure. This compares with 15–20 gallons at 20–25 lb. nozzle pressure required in the usual atomizing equipment. Fans discharge into a simple duct system but special diffusing and adjustable outlets permit uniform distribution over the entire working area.

In a well insulated plant of this type much of the necessary heat for winter operation is derived from the operation of the machine tools themselves. Actually very little additional heat is required when the plant is operating.



Heald Internal Grinder for cylinder barrels

Ex-Cell-O Hydraulic Angular Type Boring Machine



Only exception to the special light green paint used on the machines is this Special Two Spindle Boring Mill by W. F. & John Barnes. It is finished in black and chromium.

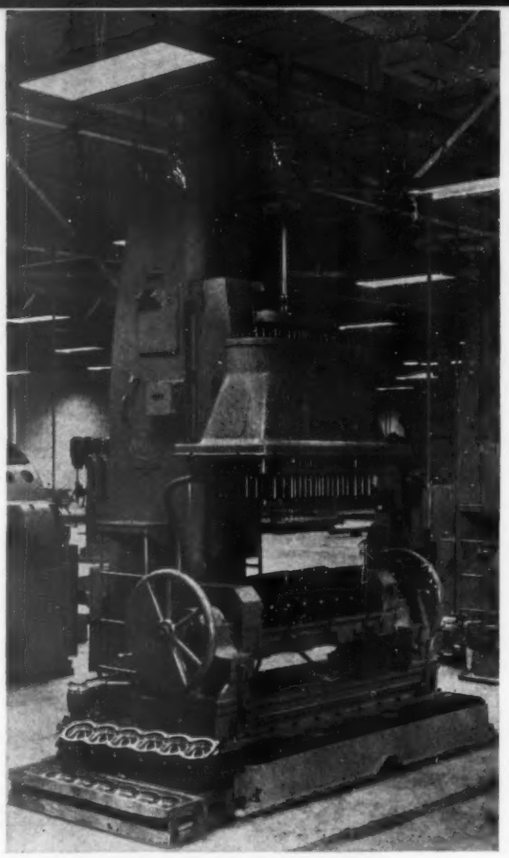
The additional heat is obtained from a waste heat hot water boiler, augmented in extreme weather by an oil burner.

This degree of air conditioning and heating is used only in the central portion of the building which contains the manufacturing and assembly operations. Adjoining sections include the three story office building section in front which is to be conditioned at a lower effective temperature than that of the factory and the paint shop which has its own unitary capillary unit. The receiving room at the east end and the plant maintenance, power plant and other sections on the south side are not air conditioned and are used as air locks.

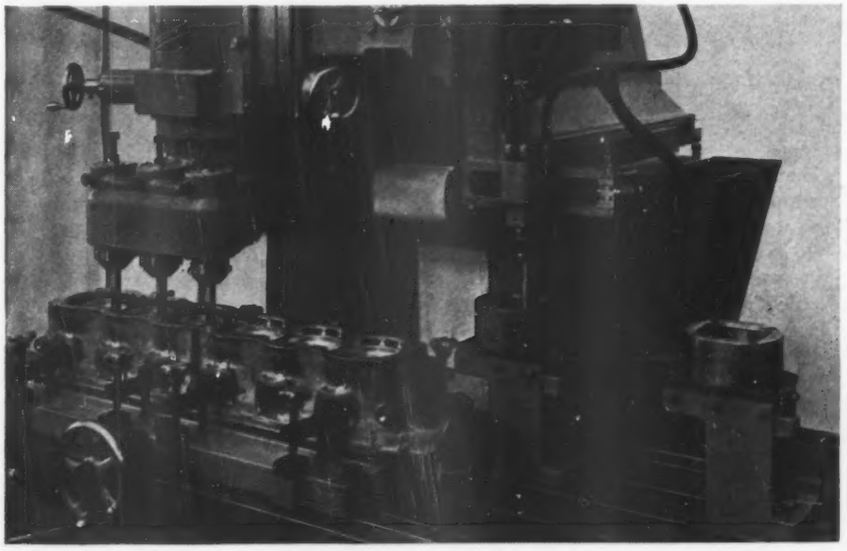
An ingenious self contained power plant, utilizing G. M. Two-cycle diesel engines and Electro-Motive generators has been incorporated in the set-up. The generators may be used as motors to drive the compressors for the air conditioning system. The isolated power plant is connected with the lines of the local utility company thus providing two sources of supply to assure full time operation.

From a power consumption standpoint the necessity for continuous lighting is not as much of an extravagance as it first appears. Experience shows that much artificial light is wasted in daylight plants because lights are burned about 65 per cent of the time. The 35 per cent of the lighting consumption saved in the older type of plant is saved at Allisons by the high efficiency of the fluorescent lighting system. It is difficult to believe that one of these units consumes but 120 watts (40 watts per tube) particularly when you have the opportunity of comparing its effects with the relatively dim yellow light of one of the few 200 watt mazda bulbs that are scattered around for the use of the watchmen. But if you climb up the ladder and touch the bulb and the

(*Turn to page 100*)

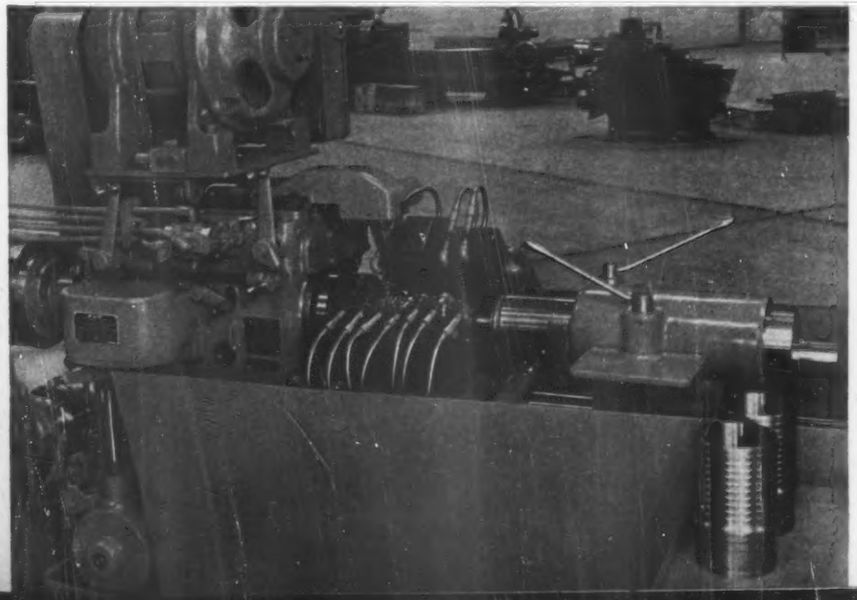


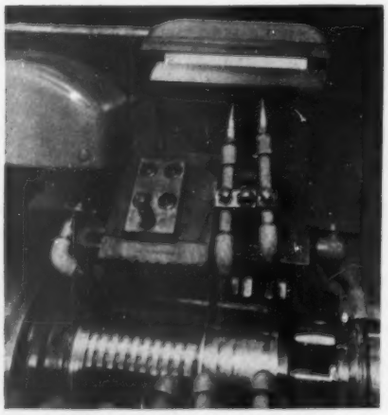
More than fifty holes can be drilled at once on this Natco Multiple Spindle Drill.



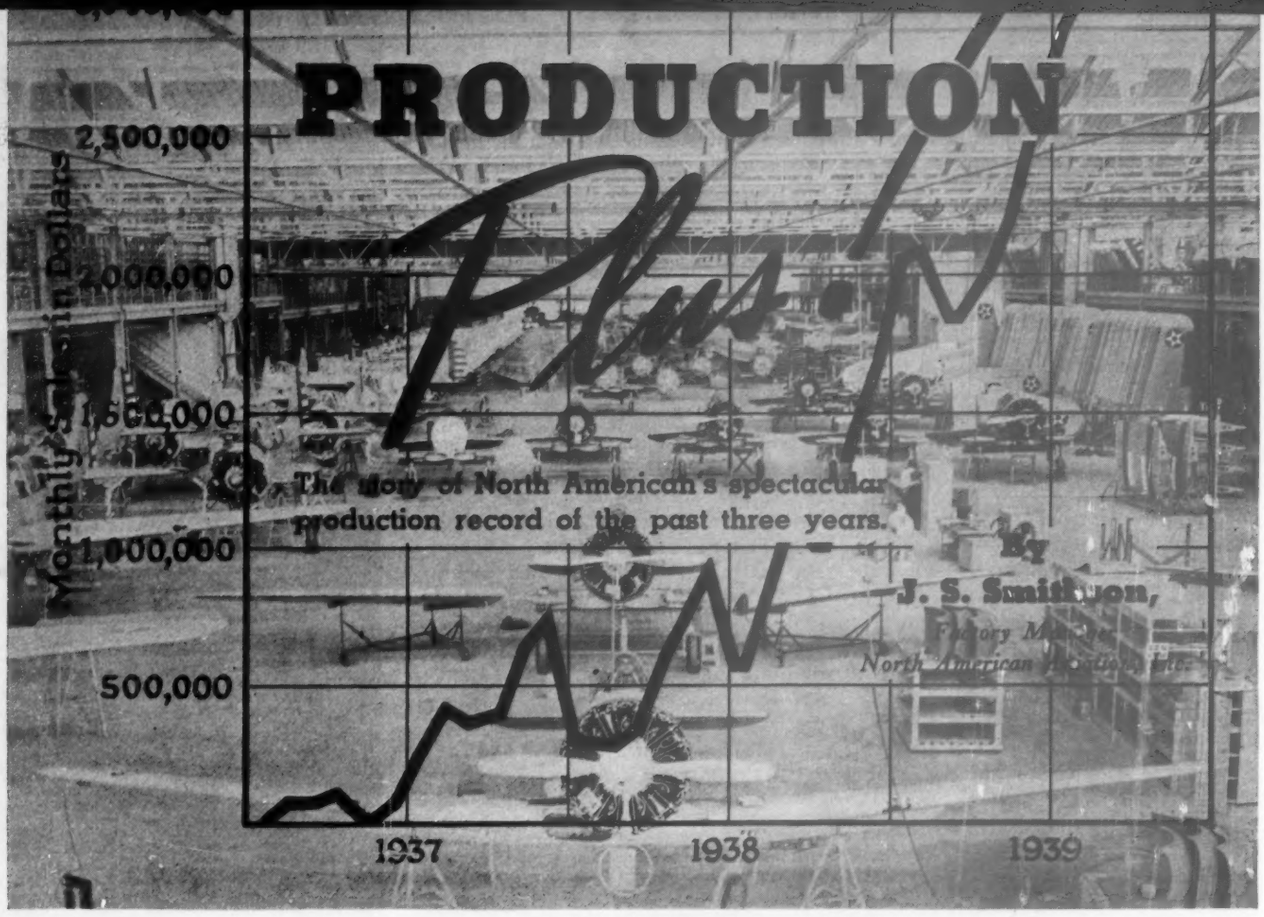
Several fixtures have been designed for the Cincinnati Hydro-Tel Vertical Mill.

Along the non-ferrous production line the gear-case is machined on this Bullard Turret Lathe.





The outside of the cylinder barrel is machined in one operation on this Fay Automatic Lathe. Special tooling and a fluorescent light (above).



REVIEWING the sales curve established during the past few months, and after watching the finished airplanes roll off the final assembly line in systematic order, one feels that something really worth while in aircraft production has been accomplished at North American Aviation.

However, it is all too easy to overlook many of the contributing factors that go to make up a smooth and efficient flow of production. We have been very fortunate in that we have received orders for airplanes in rather large quantities, which has enabled us to utilize our organization and factory to the very best advantage. Another bit of good fortune is that our factory buildings were recently constructed, which enabled us to design them to fit the modern methods now employed in the manufacture of the modern airplane. Also, we have expanded our organization gradually which has given us a healthy condition with regard to training personnel and has enabled us to keep most of our trained personnel steadily employed.

Further in the article our factory layout will be described in more detail, but at this point it might be interesting to take for example a contract for two hundred planes and trace it through the factory. Upon receipt of such a contract, written General Orders are issued from the president's office. These orders assign the account number, quantity of planes, and give the authority to proceed with the contract.

The engineering department proceeds with the detail design of the airplane, keeping in mind that the well engineered airplane is designed for production as well as for performance. A design engineered for ease of manufacture and assembly is the first and most important contribution to efficient line production. This is largely accomplished through close cooperation between the engineering department and various shop supervisors, during engineering.

During the engineering period many other departments lay their ground work. The statistical analysis group familiarize themselves with the design of the airplane and commence their work by setting up a budget of hours for each department, a sequence of manufacture, and a time spread for all sequences. After the budget and time spread are established a master schedule is made and from this a labor curve for each department is established and incorporated with labor curves of all contracts in process. In order to smooth out the total labor curve and also to avoid an excessive labor turnover, it is sometimes necessary to change the new schedule or the schedule of other contracts in process.

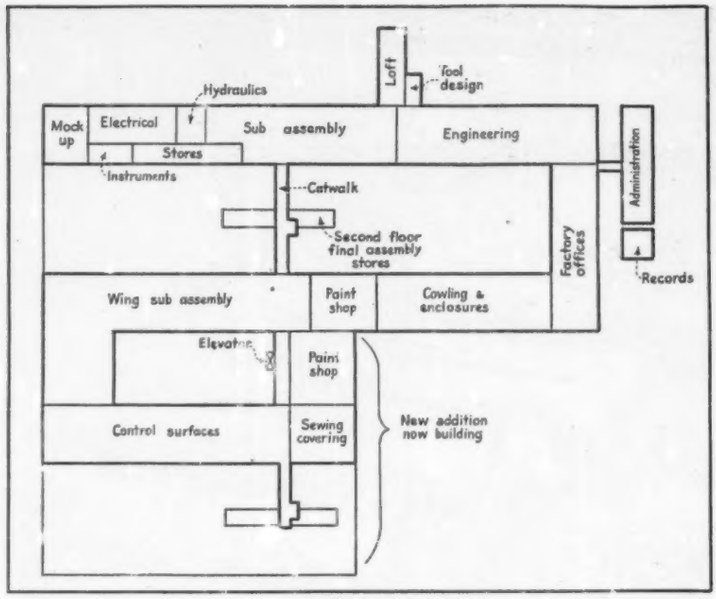
With our method of scheduling it is possible to change the schedule throughout the entire factory on any contract in process in a very few hours. If the combined result of all labor curves shows an increase in personnel, the Personnel Department is notified of requirements and the necessary new employees are lined up in advance. All labor curves are corrected each month to agree with actual conditions.

A contract for two hundred airplanes is generally divided into units of twenty airplanes each, with the exception of the first unit which is usually for from one to five airplanes to provide for preliminary checking of tooling, etc. Each unit, or block of airplanes, is given a letter for identification. Budgets, schedules, cost analyses, and manufacturing orders are all based on these units. It is possible to keep a foreman of a given department posted as to hours expended as compared to the budgeted hours so that he may better measure the efficiency of his department.

The Tool Design Department ob-

tains advance prints of design drawings as fast as they are produced by Engineering. Careful consideration is given to the tooling of each and every detail part, as well as the major assemblies. At this stage it is not too late to recommend changes in design to further simplify the part or assembly for ease of manufacture. Many shop foremen are called in conference over drawings to pass their experienced judgment on design from the standpoint of manufacture.

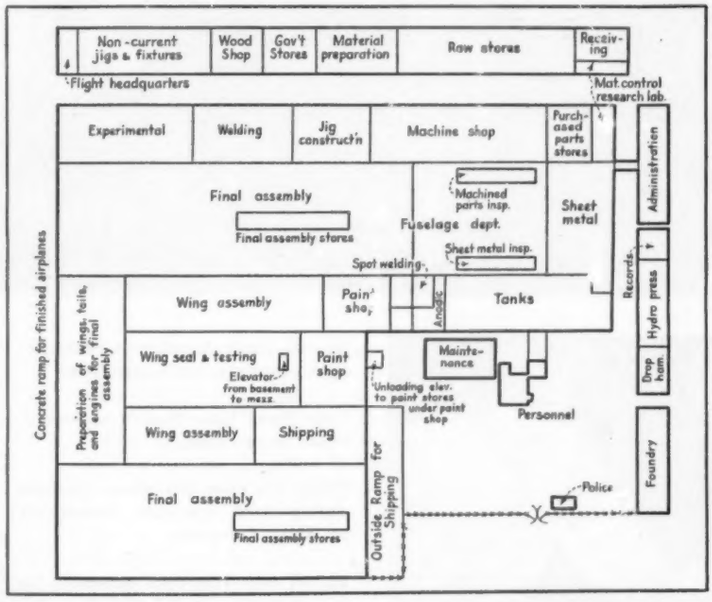
While engineering proceeds, the Material Control Department builds up its material requirements. The M.C.D. has been carefully organized to prepare, in a minimum length of time, a complete Bill of Material based on engineering information; to arrange in an orderly fashion the materials from this bill on a requisition to the pur-



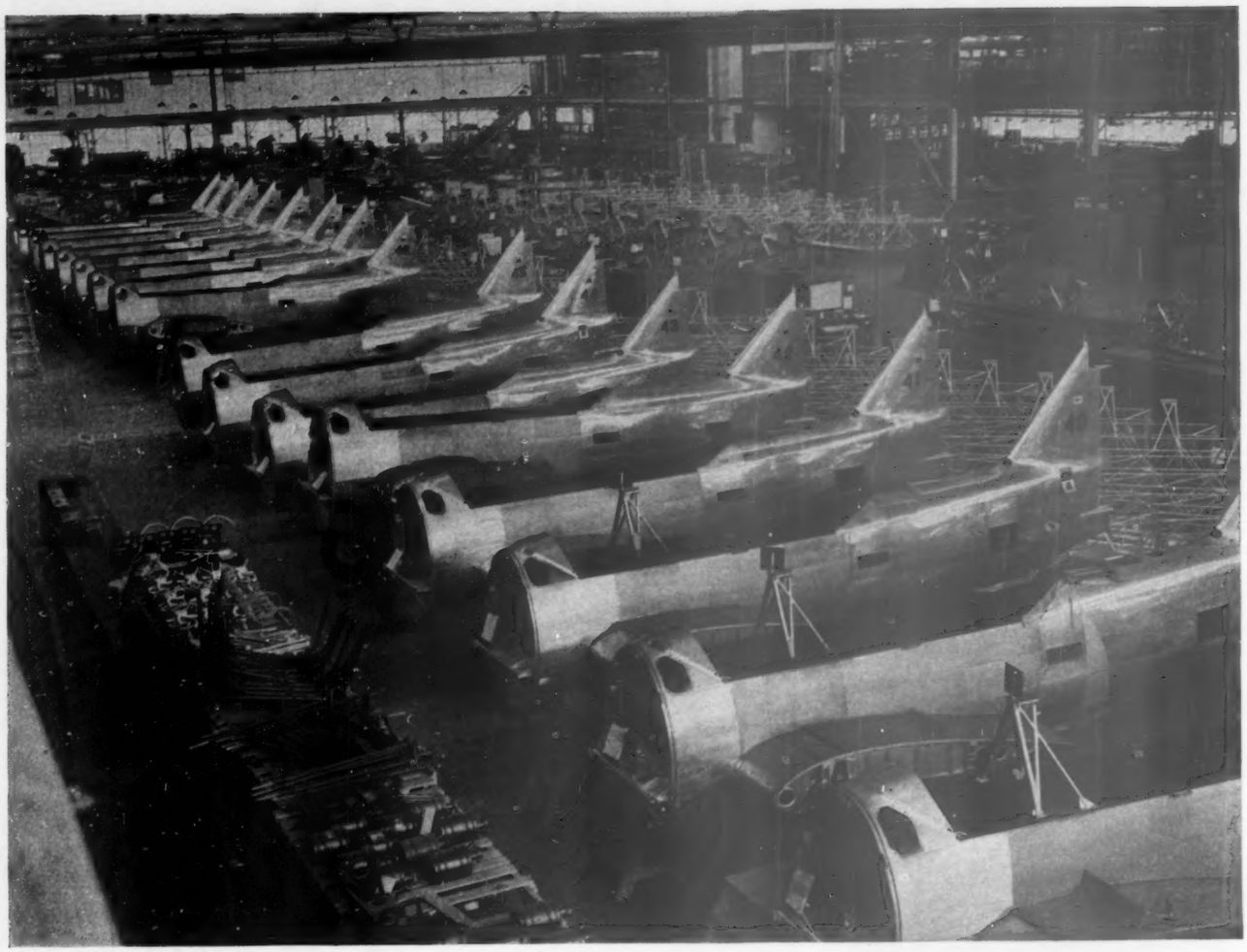
Mezzanine Plan

Right: Plan view of North American's plant, showing general location of departments on main floor and on mezzanine.

Below: J. S. Smithson, factory manager, North American Aviation, Inc.



Present building is 300 ft. x 700 ft., includes 500,000 sq. ft. of floor. Fifty percent additional now under construction.



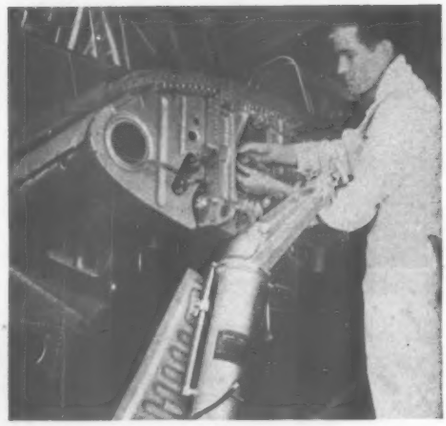
Above: North American's assembly floor, showing production line.

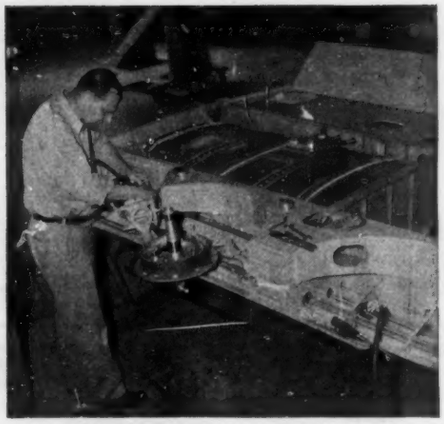
Left: Final inspection of a complicated wing fitting.

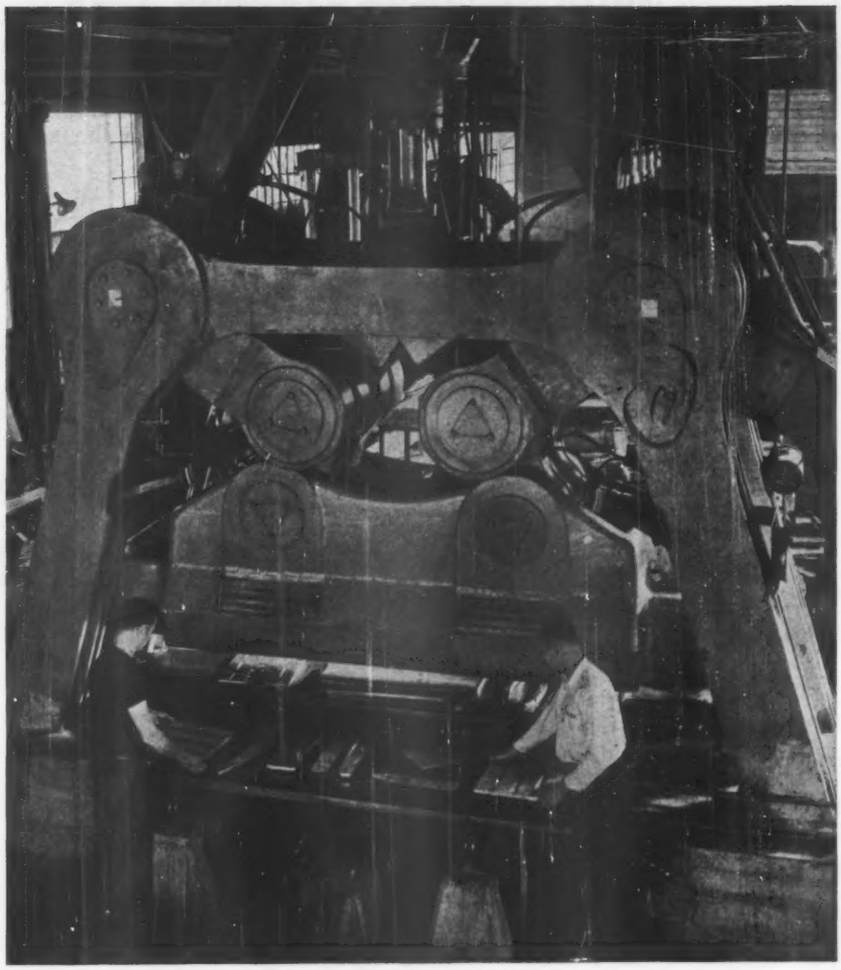
Right: Workmen are never crowded during final operation assemblies at North American.

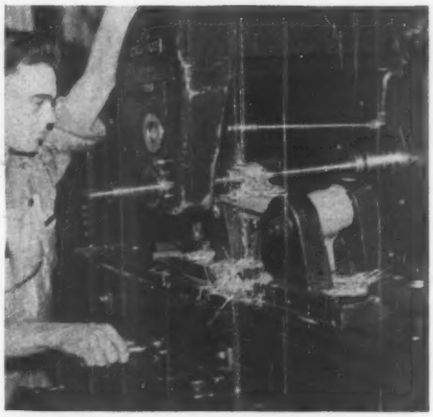
Below, left: This final assembly jig is rotatable and provides the worker with complete access to wing-center section assembly.

Below: Precision finishing operation on blanking die for instrument panel.









Above: This huge toggle press was designed by North American engineers and built by Joshua Hendy Iron Works of Sunnyvale, Calif. Sliding tables take a new setup while a forming operation is going on in the press.

Left: Carefully engineered fixtures assure accurate machine work and interchangeability of parts.

chasing department for procurement; to requisition these materials according to a required date based upon—first, the schedule—and secondly, the time for the vendor to produce the article and make delivery; to continually check the required dates on these requisitions to determine whether or not they will be adhered to and to notify the production control department of any delay or possible delay; to perpetuate an inventory and control the usage of materials through this means; to maintain a rigid and strict surveillance on materials for standardization; and to order plenty of material but not too much.

As working drawings are finished and checked by the Engineering Department a steady stream of prints begins to flow to the Planning Department. Here all shop orders are created. These orders route the parts through the various departments and processes. Information regarding all tools and jigs is automatically furnished this department by Tool Design. This enables the planner to coordinate the operations throughout the factory. The number of shop orders leaving the Planning Department has averaged, for the past six months, over a thousand every working day. Each block of orders is released in the proper sequence and on the required date, as predetermined by the master schedule. In addition to planning the routing of work orders, this department must maintain a foolproof system of releasing in order to be certain that every one of the thousands of parts that go to make up an airplane is properly and completely released.

At this stage engineering work is nearing completion; the tooling is well under way, and the work orders for the first group of airplanes are being issued. These orders first clear the Material Control inventory for deletion. If material is not available, such orders are held in the "urgent file" while material deliveries are expedited. This method serves as a double check and eliminates any possibility of orders getting into the warehouses or fabricating departments before material is ready.

Orders for all sheet metal details enter the Preparation Department adjoining the warehouse, where parts are sheared, profiled, and edges burred. Blanks then move from this department to the hydro press room and drop hammer room, then heat treat, inspection, processing—and are then delivered to a stockroom in one of the assembly departments.

Orders for all machine parts are usually released for the total requirements. These orders are held in the machine shop control station for coordinating, and are issued for machining in as large a quantity as can be run at one time. This is done in order to save unnecessary additional set-ups. From the machine shop, parts are inspected, processed, and delivered to a stockroom in the sub-assembly department.

Assembly orders go direct to their respective stockrooms, where they pick up the necessary detail parts for the assembly departments concerned.

As parts or assemblies move from one department to another they are recorded on work sheets which are turned in to the Production Control headquarters at the end of each day. A night shift posts the movement of each part in progress books. These

books list each part in a manner that enables the follow-up man, reviewing the progress books next morning, to see the parts that are lagging behind. The follow-up man makes his contacts regarding parts behind schedule through control stations established in each department. These control stations also maintain an open order file of all current work orders in the department they serve. These files are divided in such a manner as to enable the foreman quickly to see the volume of work in his department, and if any of his work is behind schedule or if essential materials are missing.

Production planning and plant lay-out have been coordinated to achieve smooth line production. This is accomplished partly by keeping the final assembly floor as clear of detail parts as possible, and by assembling in other parts of the factory, sub-assemblies which can be instaled on the airplane with a minimum amount of effort. A complete set of locating jigs for every installation is a further help in minimizing effort during final assembly of the airplane.

An essential part of maintaining smooth production is provision of all parts and assemblies at their required positions on the final assembly floor as they are needed. Final assembly operations are divided into positions at each of which specified assembly operations are performed. In this way it is possible to control all operations in such a manner that the individual workman is never crowded, and always has complete access to his work.

Also of vital importance is the provision throughout the plant of the very latest and most modern equipment and methods.

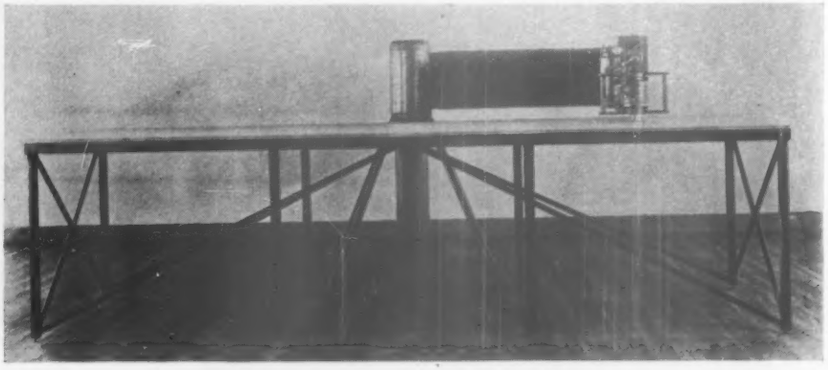
As the accompanying floor plan drawings will illustrate, the mezzanine provides a large amount of space for grouping sub-assembly and manufacturing operations around the final assembly floor and with the most efficient location with respect to final assembly. Individual stockrooms and inspection departments are maintained in each sub-department, greatly simplifying handling of all parts and assemblies. Handling is further aided by giving the greatest attention to monorail systems, trucks, movable work jigs, etc., so that man-power is minimized and all parts or assemblies are fully accessible at all times.

It would be unfair to conclude this article without paying tribute to the entire body of employees at North American who have made possible the establishment of an outstanding production record.

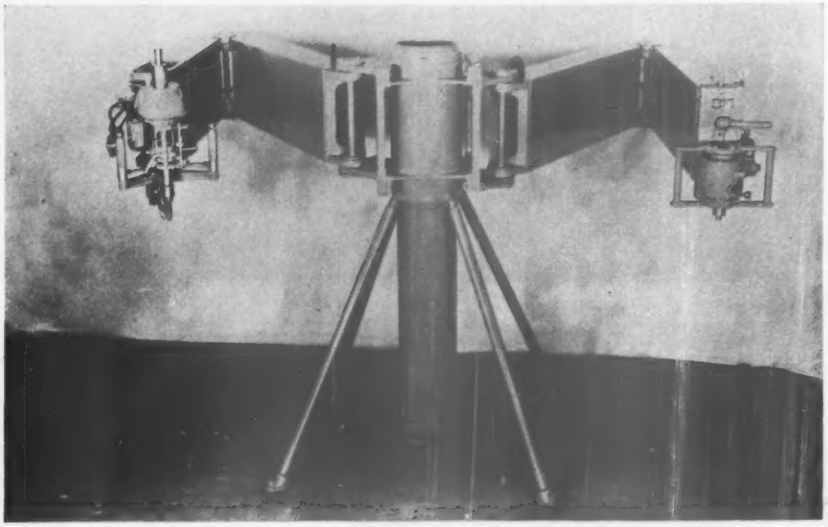
North American Profiling Shop

A picture story showing a special type of equipment which has been highly developed by North American engineers for production drilling, routing, and profiling. Many operations other than those shown may be carried out with the same machines.

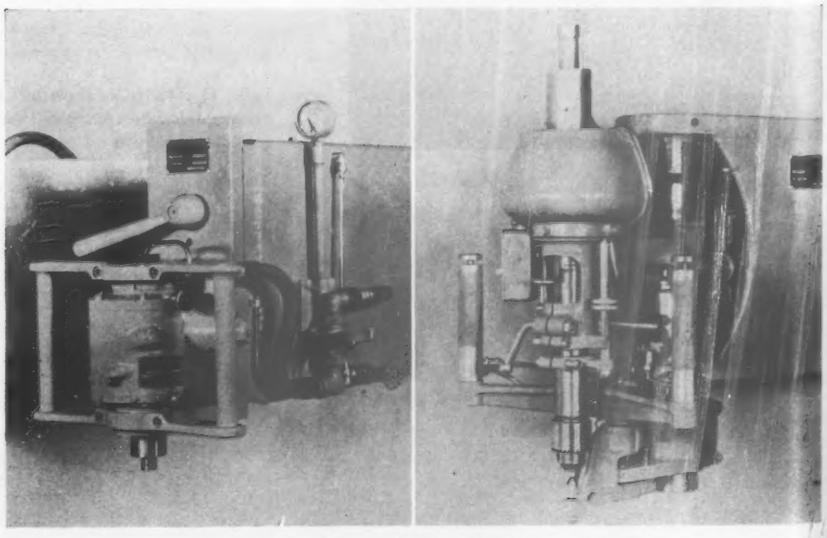
Photographs, Courtesy of Martin Holland North American Aviation, Inc.



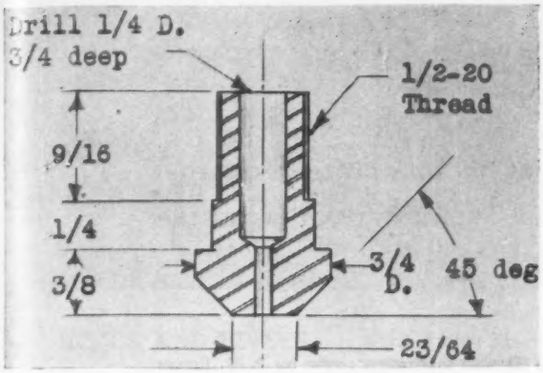
Rotating arm router and work table.



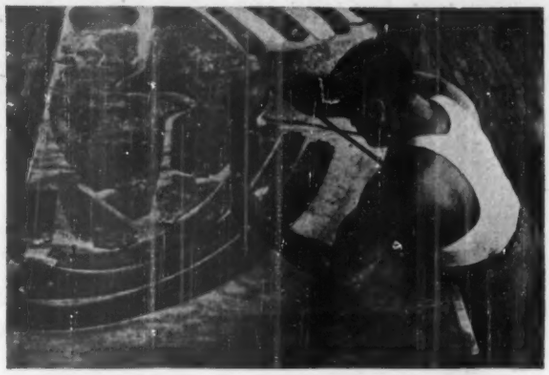
Combination mounting, rotating arm router, and drill.

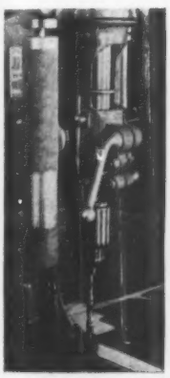


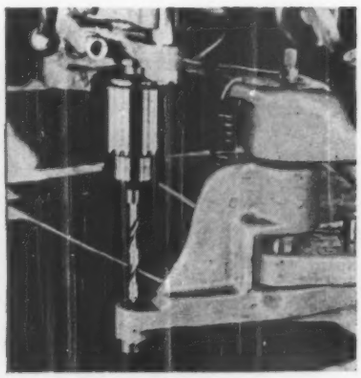
Detail of router and drill heads shown above.



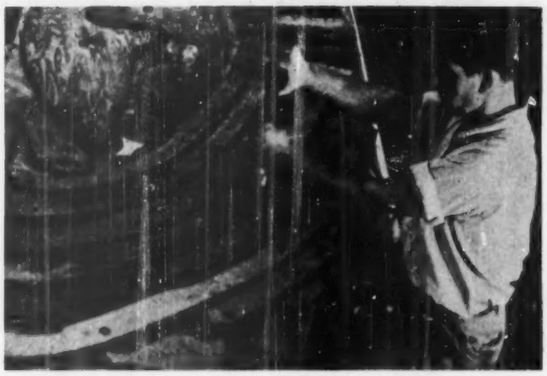
1.
General size and shape for drill guide bushings of hardened tool steel.



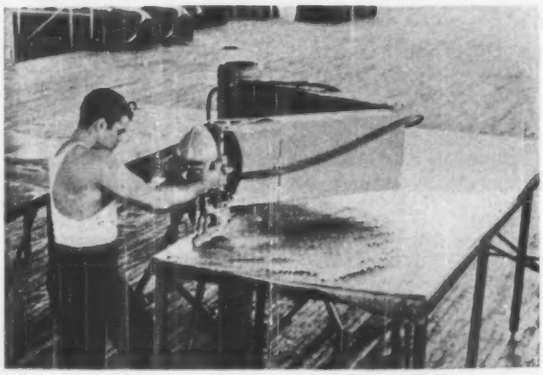


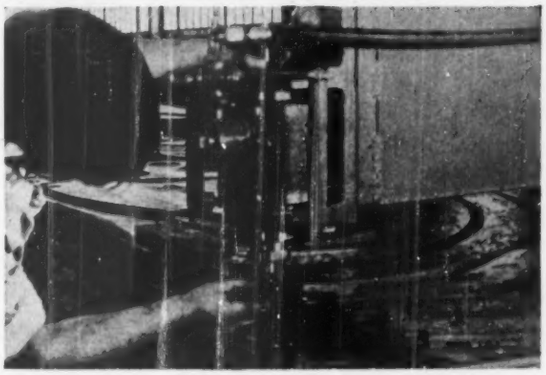


2.
Hold-down foot (in position on drill template) is operated by air cylinder controlled by thumb valve.

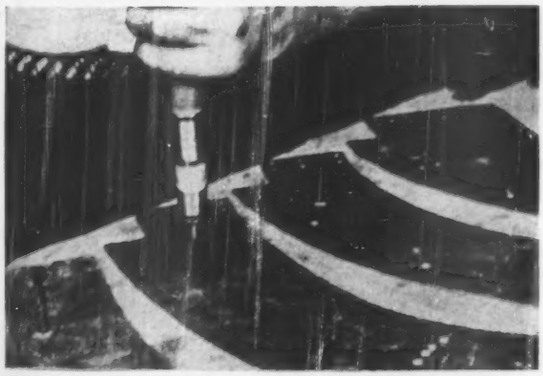


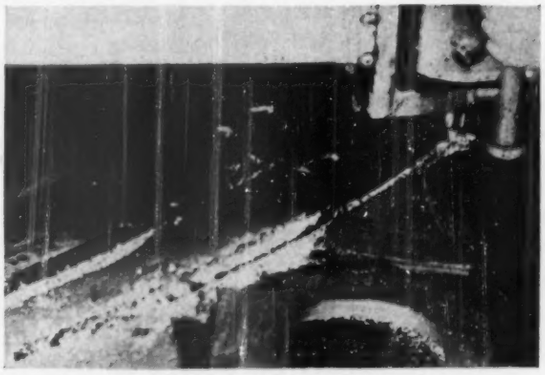
3.
Drilling tool holes through fifteen sheets of .32 in. stock at once using a 22-gage galvanized sheet iron master template.



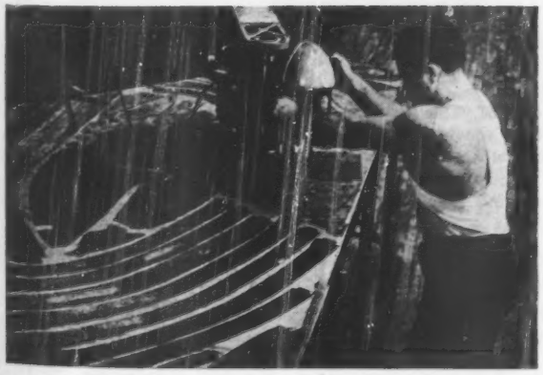


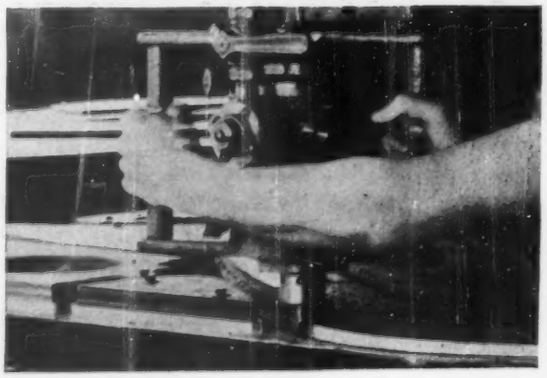
4.
Individual layout templates are placed on sheet packs and fastened to table top by lag screws through the tool holes.





5.
Drilling holes through layout templates. Hold-down foot (see above) clamps sheets tightly together, preventing burring.





7.
Router jigs are located on sheet stack and fastened down in same manner as layout templates.

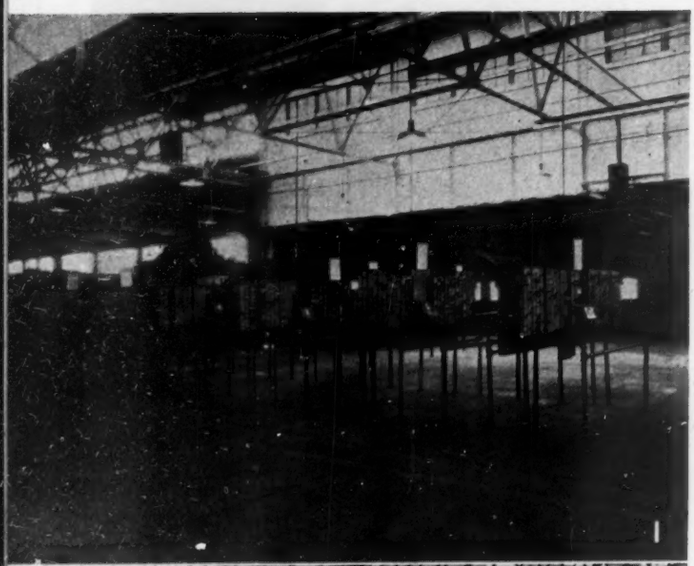
8.
Roughing collar is installed on router guide. Mixture one part lard oil—three parts kerosene fed to cutter through hollow spindle of router head.

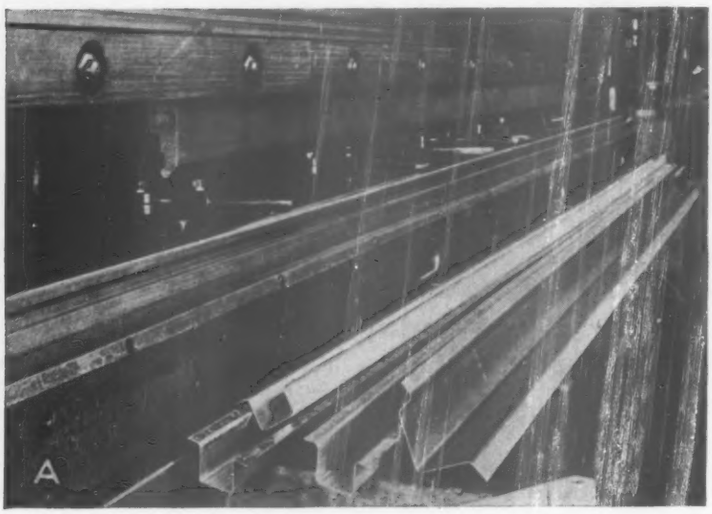
9.
Cuts are made holding router guide against edge of router jig. Roughing cuts leave 1/32 in. metal around profile for finishing.

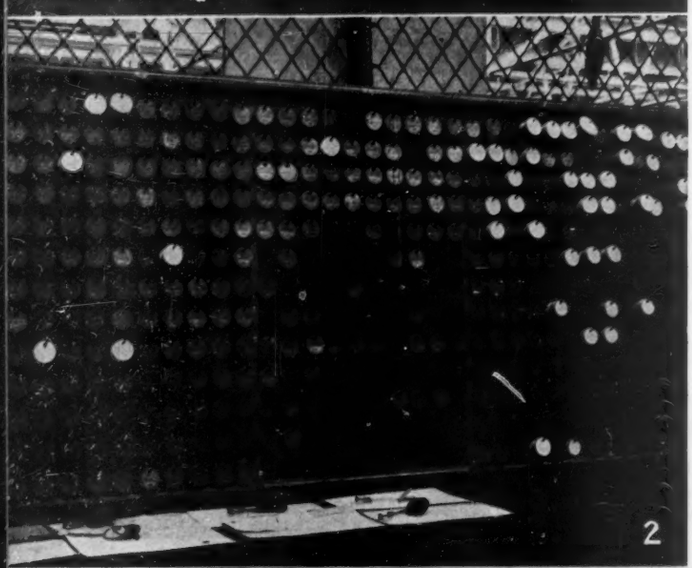
10.
By removing roughing collar, a 1/32 in. finishing cut completes operation on sheet stack.

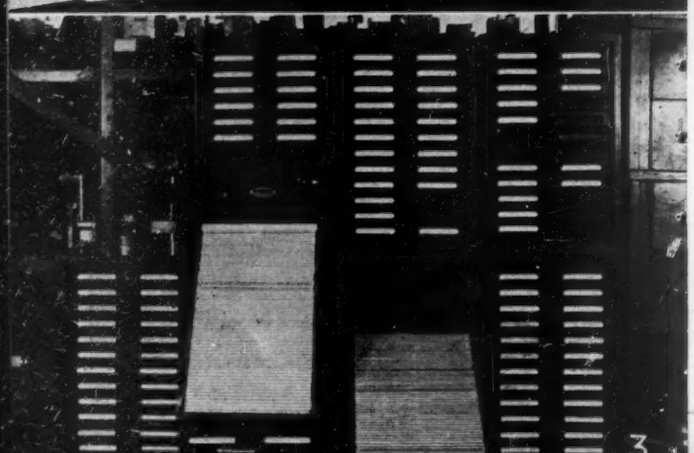
Glimpses of manufacturing operations in the Curtiss-Wright plant at Buffalo, N. Y.*

* From an S.A.E. Aircraft Production paper by P. N. Jansen.









SHAPING AND FORMING

A—A 12-ft. modern power brake. Because of the multiplicity of parts and problems there is always one piece of equipment on which a job can best be done. A variety of equipment is therefore justified to provide flexibility and stimulate progressive production ideas. It also permits more latitude for the designing engineer.

B—An operation performed in a crank press for forming with rubber the bead on an exhaust pipe clamp.

C—An air-operated drop hammer. The air lifts the ram but the drop is by gravity only.

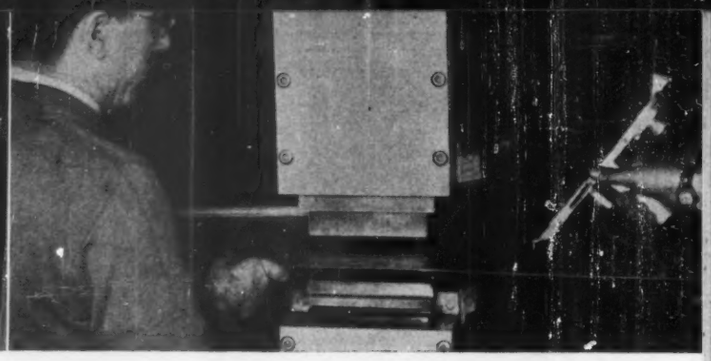
D—A double acting hydraulic press of 700 tons capacity. This press has a 500 ton capacity on the primary ram and an additional 200 lb. for the pressure pad.

CONTROL

1—Central clock bay for entrance and exit of all personnel except office force and staff. This is located near the middle of the plant and is easily reached by a series of aisles which divide the main building into four parallel bays. The three main aisles are intersected by four cross aisles. This arrangement provides ample traffic handling facilities, simplifies policing and reduces stealing. It provides a quick and orderly exit to the employee parking area.

2—Checkboard for control of portable small tools. This has proved a practical method for keeping a running inventory of the small tools in use on the production line or in storage.

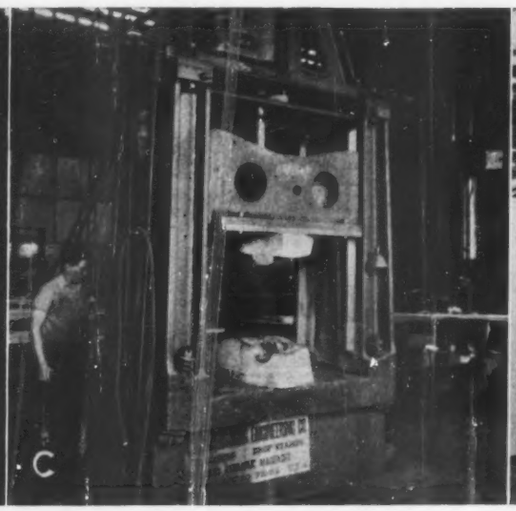
3—Kardex perpetual inventory setup does the paper work in the Buffalo plant of Curtiss-Wright.

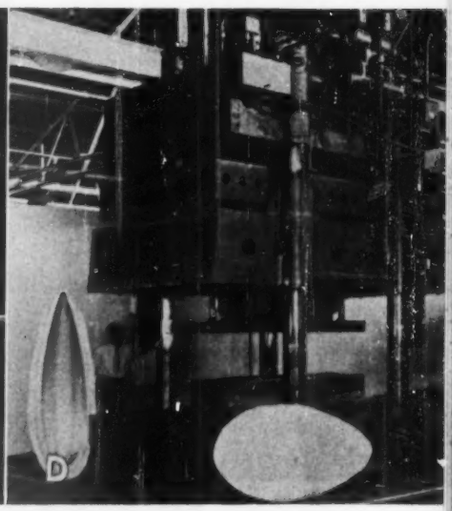


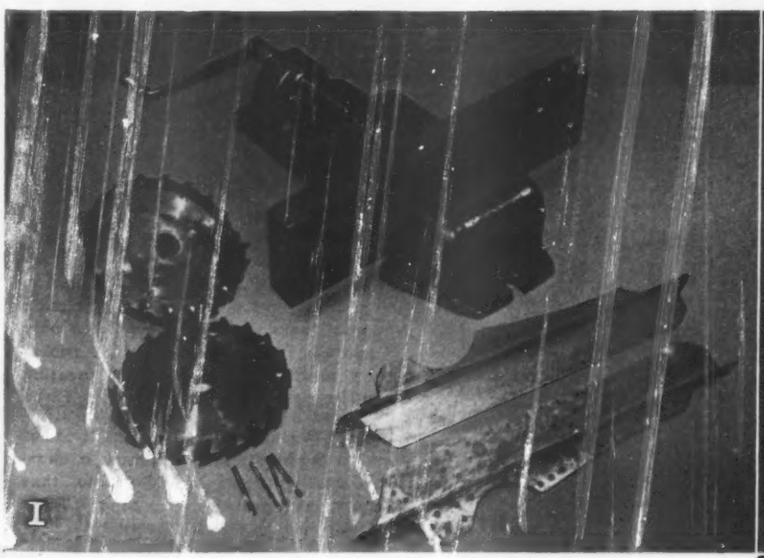
HOLES AND RIVETS

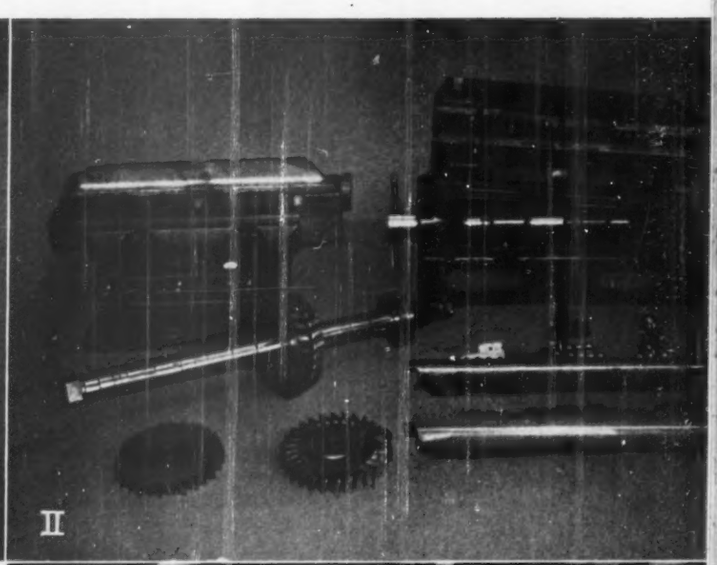
Stack drilling operation from template. The stack drill rotates within a fixed bushing.

Gang riveting with a specially designed pneumatic riveter. Brazier as well as flush rivets may be used.









TOOLS AND JIGS

I—The "hogged-out" fitting for an experimental job and a few tools employed in machining the part. Here the machine operator requires greater skill than the one assigned to the production article, and considerable layout and set-up is necessary..

II—The same fitting made from a forging and tools for high speed interchangeable production. This requires a somewhat less skilled operator. No layout and only a routine set-up.

III—Trimming a wing butt is the final operation on an expensive unit. It may not take long to learn this operation but it is considered skilled because of the judgment required.

Bench drilling location holes in template for small sheet metal part for the DC-3.

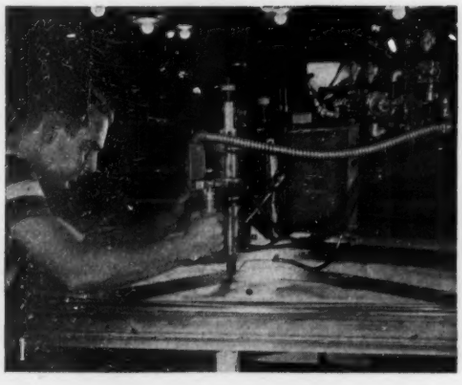
Forming individual sheet stock blanks on power punch press.

Forming sheet metal part of complex shape on power brake with special dies.

Inspecting semi-finished sheet metal part formed on punch press and power brake.

Sheet Metal Operations at Santa Monica and some typical Machine Work at the El Segundo Plant.

Looking Around the **DOUGLAS Plant**



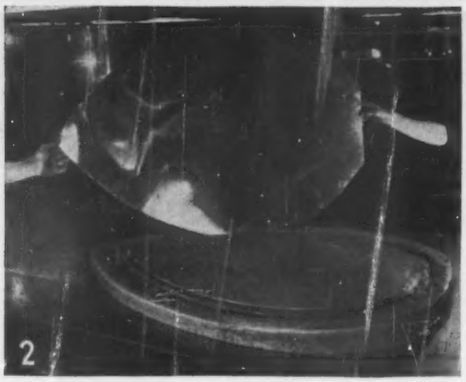
1. First step in the manufacture of a fuselage former for a DC-3. Drilling of rivet and bolt holes on special drill table layout with templates clamped on top of multi-sheet stock stack.

2. After all holes are drilled in the sheet stock, router jigs are clamped in place and movable head router is used to profile the part as shown.

3. Completed flat sheet blank, drilled and profiled, but not yet formed. Next step is the hydro press where forming will take place over the die shown. Note pins on die and pin holes in part, to maintain proper alignment. Hydro press uses only a male die, against which thick rubber pad is pressed to complete the pressing operation.

4. Here is the formed channel as it comes from the hydro press. It is now a channel section properly relieved to take stringers, and drilled for riveting.

5. Final step in every operation is inspection prior to release of part for stock room, or assembly.



Picture series above:

1. Here is the rotary shear again, being used to profile a flat sheet blank of fairly regular shape from a rectangular piece of sheet stock for the DC-3. This work can be performed quite rapidly as the blank is to be formed and so does not have to be cut with great precision.

2. Now we see the blank and its hydro press die with which it is to be both formed and sheared to exact size. Shearing is done by pressing with the rubber pad against a sharp-edged portion of the die. Results are surprisingly uniform and satisfactory. This process is patented by the Douglas Aircraft Company. One of the world's largest hydro presses is used for this work.

3. Here is the formed part as lifted from the die. Note that the two small holes have been both flanged and sheared.

4. Here's the inspector again—checking the shear work done by the hydro press.

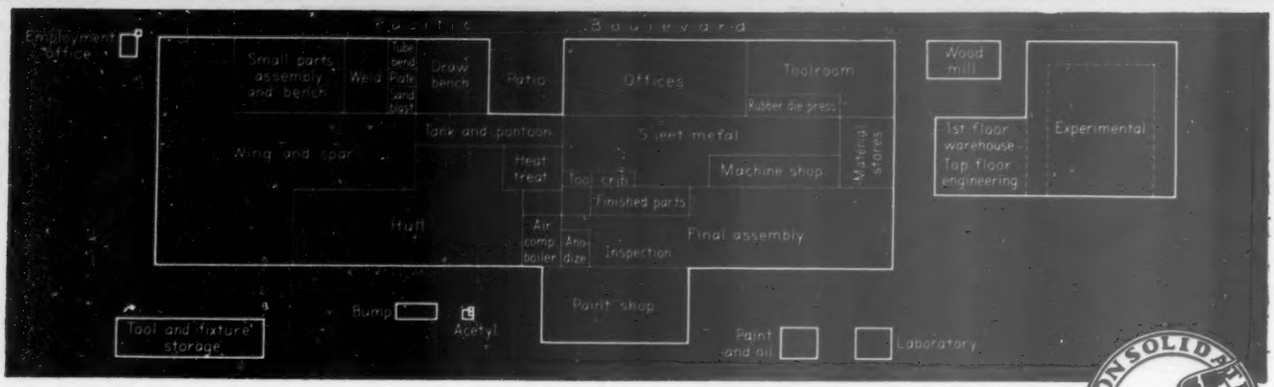
Picture series at right:

1. Machine manufacturing processes on a carburetor air elbow base used on a military airplane. Layout, preparatory to machining, must be made to hold flange hole tolerances to within plus or minus five-thousandths of an inch. (El Segundo Division.)

2. Drilling and reaming close tolerance holes is a precision operation performed in a vertical drill press.

3. Milling the base for a tight fit on the carburetor. Sides of shaft holes are milled for operating clearance.

4. Inspection. Note the care with which final dimensions are checked.



CONSOLIDATED of San Diego

Has a daylight factory built for line production of large aircraft.

By C. F. McReynolds
West Coast Editor, AVIATION

LOCATED on Lindbergh Field, San Diego, California, the Consolidated factory has been built from the ground up to handle large aircraft. We might say that the plant has been built "from the water up" as most of the ground on which it stands was reclaimed from San Diego Bay and this filled land has presented certain special problems which had to be solved in building the factory and installing certain heavy machinery. The Consolidated factory is located in the Southern California aircraft industry area which provides unusual facilities for supply of all needed materials and supplies, as well as a favorable reservoir of trained men. The plant is located on Lindbergh Field, with unobstructed access to runways, and to quiet waters for launching and flight testing of flying boats. Supplies may be and are brought in by water, rail, highway, and air, with delivery right at the factory door. Equable weather conditions in the San Diego area have made it practical to build a factory that is "all windows and doors", of relatively light, long span roof construction, and with no major heating problem. In addition, a high percentage of operations are performed in the factory yard, which serves as an integral part of the plant without requiring the expenditure of capital for roofing, heating, etc. Enclosed by a high fence, the yard area is well supplied with electric power outlets, air, water, and other facilities, and is used for a major portion of all final assembly operations. The area under roof at the Consolidated plant is approximately 450,000 sq. ft., with an additional 212,462 sq. ft. in usable yard area. The main factory building extends for 1025 ft. along the east side of Lindbergh Field, and has a width of 300 ft. Construction is of steel frame with saw tooth roof, galvanized iron siding, generous window area, and with almost continuous doors along the field side to permit shifting planes off the production line at any desired point. The east 200 ft. of the factory building has a ceiling clearance of 14 ft., as this area is largely devoted to miscellaneous manufacturing operations, machine shops, and offices. The remaining 100 ft. of factory width serves as the final assembly bay, extends the full length of the building, and has a height of 30 ft. Adjoining the main building at the center of the assembly side is the paint shop, measuring 200 by 100 ft., and also having a ceiling clearance of 30 ft. This permits shifting hulls and other bulky parts out of the assembly line, into the paint shop, and back to assembly without difficulty. An experimental building is located south of the main plant and separated from it by a 50 ft. alleyway. This building, of construction similar to the main building, houses an experimental section measuring 225 by 250 ft. with a 40 ft. ceiling clearance, and a receiving stores section 125 ft. square, with a second floor which carries the engineering department. There are two mezzanine floors extending around three sides of the experimental shop, the fourth being reserved for doors opening on the flying field. The lofting department of engineering occupies a major part of these mezzanine areas. Other Consolidated factory buildings located adjacent to the main plant include the wood mill, tool storage shed, laboratory, and paint storage building.

The modernization program recently completed entailed an expenditure of more than $500,000 for new equipment alone. Although presses and drop hammers represented the major items of expenditure, numerous pieces of equipment were added to the machine shop, including three Brown & Sharpe automatic screw machines, two Cleveland screw machines, a Cincinnati centerless grinder, and a LeBlond gap lathe to swing 50 in. For the drop hammer die foundry two James H. Knapp gas fired tilting type melting furnaces were installed, each with a capacity of 8,300 lbs. of zinc alloy or 12,000 lbs. of lead. To supply power for the new air operated drop hammers a Worthington 20 in. x 12 in. x 14 in. horizontal two stage compressor was installed. Driven by a 200 h.p. electric motor, this compressor has a capacity of 1150 cu. ft. of air compressed to 100 sq. in. per minute. This brings the total air compressor plant to a capacity of 2275 cu. ft. per minute. A stand-by

1. Riveting is largely the means of fabrication for today's large aircraft. Squeezers, guns and hydraulic yokes are employed.

2. Pneumatic tube bending machines are now coming into use. In the Model 28 Consolidated twin engined flying boat, approximately 900 feet of tubing is employed.

3. Power end of the cable stretching machine with a capacity up to 20,000 lb. Designed and built by Consolidated Aircraft for pre-stretching all control cables.

4. Back spotfacing a fitting through use of a drilling fixture.

5. A multitude of small machined parts are made for use in the airplane. Here cable terminals are being milled in a special fixture.

6. Cold working of dural parts increases their strength. Thin sections, extreme curvatures, bring problems not encountered elsewhere.

7. Rivets of many sizes and shapes to the tune of a million per week can be turned out by these two rivet making machines.

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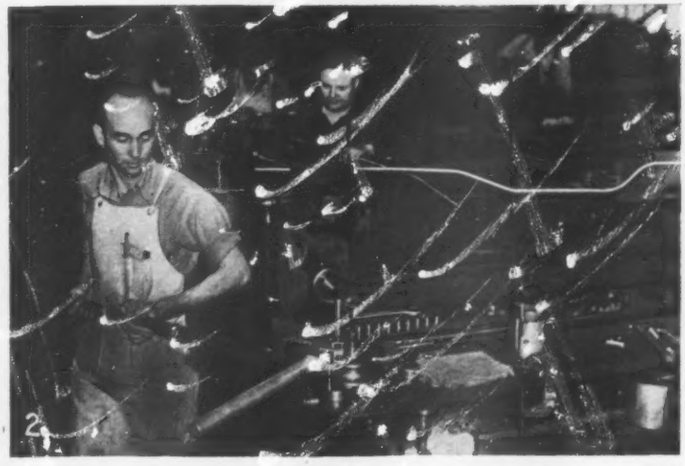
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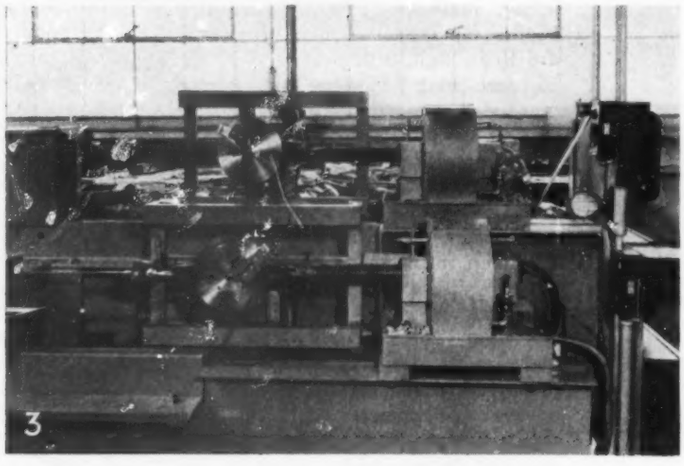
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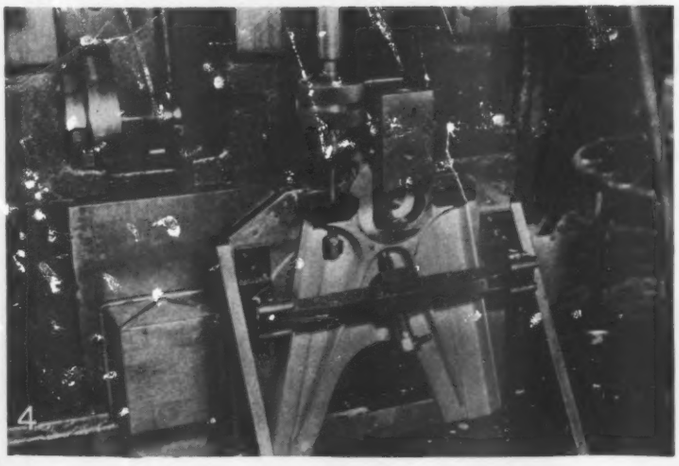
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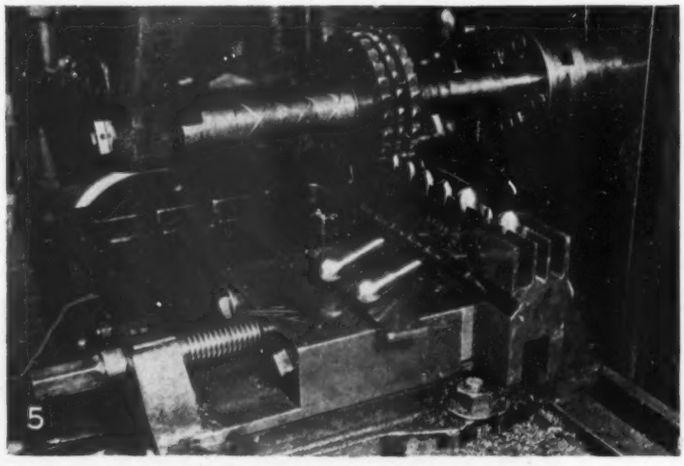
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7

system is provided to supply Butane gas to the boilers, heat treat equipment, and furnaces in emergency.

A new salt bath furnace was installed in the heat treat department, with a capacity to heat treat 2000 lbs. of aluminum alloy parts per hour in a salt pot 21 ft. long and requiring approximately 18,000 lbs. of potassium nitrate and the same amount of sodium nitrate for its initial charge.

Additional facilities provided in the paint shop include a huge paint booth for hull finishing. Measuring 30 ft. long, 20 ft. wide, and 18 ft. high, this booth has complete lighting and ventilating facilities. Two open front booths for miscellaneous spray work are 10 ft. high, 8 ft. deep, and 30 and 65 feet long respectively. Air is pumped through the paint shop at the rate of 203,000 cu. ft. per minute by means of nine exhaust fans requiring 62½ motor horsepower.

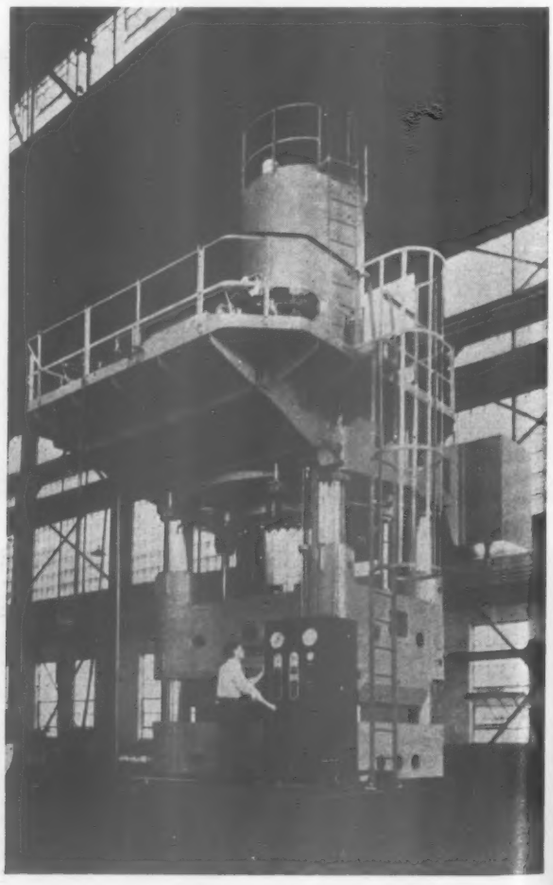
Major new equipment item, and the center of greatest interest in connection with the modernization program, is the battery of presses and drop hammers installed. This includes a 4500 ton Birdsboro hydraulic press, a 1000 ton Hamilton double crank punch press, four Chambersburg air operated drop hammers, and four new rope lift type drop hammers of Consolidated design and manufacture. The Birdsboro-HPM press has a 48 in. working stroke, a platen area 140 by 118 in., a total weight of 610,000 lbs. and a foundation weight of 225,000 lbs. The air operated drop hammers vary in size from 101,000 pounds gross weight down to 33,000 lbs. The big hammer has a stroke of 72 in. and platen area 48 by 96 in. It can accommodate punches, or dies, up to 50,000 lbs. in weight. The foundation weight, for the inertia block alone, amounts to 415,000 lbs.

Installation of these drop hammers occasioned unusual engineering difficulties due to the filled ground on which the plant is built, which we referred to earlier. Since the hammers were to be installed in the center of the main factory and quite close to the offices, it was considered desirable to minimize if not eliminate the pounding action usually associated with operation of drop hammers. Also, due to the unsatisfactory bearing qualities of the sub-soil, it was feared that such a heavy drop hammer would pound its foundation, no matter how massive, right down through the floor and out of sight. Load bearing and vibration transmission problems were solved simultaneously by provision of an ingenious "earthquake proof" mounting. Steel piles of "H" section were first driven 60 ft. into the sub-soil. As the roof clearance was only 30 ft. it was necessary to drive these piles in increments, welding on short sections as the work proceeded. A heavy concrete foundation "box" was constructed on top of these pilings, with the top of the box open and flush with the factory floor. Inside the box an inertia block was constructed and suspended from steel beams floating on Korfund coil steel springs supported on the foundation box. The drop hammer, mounted on this inertia block, transmits its shock to the block, resulting in a maximum deflection of the steel springs of about ½ in., and eliminating all shock to the main foundation box or the building proper.

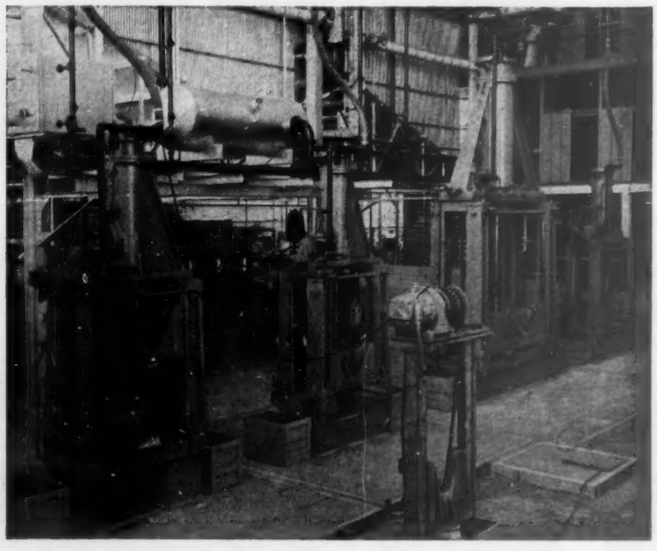
Aircraft jigs and fixtures have always represented a special problem. Quantities have rarely justified development of permanent jigs, with durable steel fixtures and locating blocks. But wood jig parts, however satisfactory for assembly of a few planes, have not been satisfactory for production in quantities of fifty or more, due to cracking, chipping, swelling, wear, etc. Consolidated has solved this problem by melting up all aluminum alloy scrap and casting it into standard shapes and sizes suitable for use in jig and fixture work. Where very large jig parts are needed, for location of wing to f... age, etc., a single member can be conveniently cast in the alloy metal. This metal is relatively easy to machine and work

(*Turn to page 102*)

This Birdsboro — HPM press has a 48 in. working stroke, a platen area 140 x 118 in. and a total weight of 610,000 lb.



These new penumatic drop hammers are mounted on inertia blocks supported on coil springs and specially driven steel piles.



IT PAYS TO FLY
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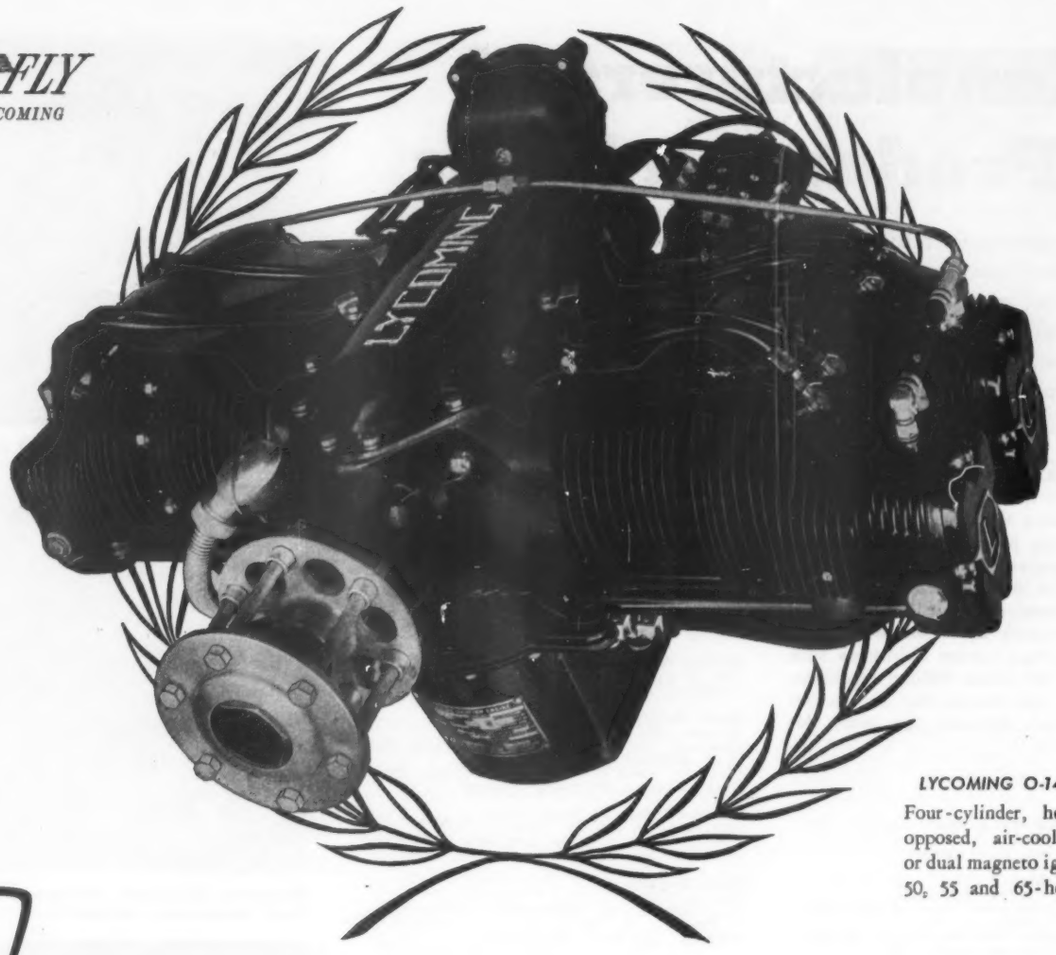

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FREE LITERATURE: Illustrated folders on Lycoming light-plane engines may be obtained from all Aeronca, Piper Cub or Taylorcraft dealers. Or write Dept. A129, Lycoming Division, Aviation Manufacturing Corporation, Williamsport, Pennsylvania, U. S. A. Cable Address: Aviatcor.

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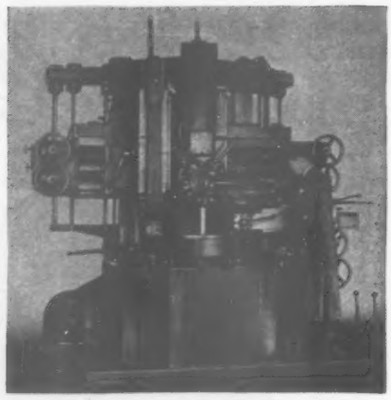
Manufacturers of Production Tools

As a convenience to those responsible for aircraft production, AVIATION has assembled the following directory of manufacturers of aircraft production tools. Each of the five groups represents one consecutive phase of production, and each contains manufacturers alphabetically arranged whose products perform operations pertaining to that phase.



Cut Master Machine—The Bullard Company

GROUP I—TRIMMING AND FORMING—contains the list of manufacturers of Presses, Forming Machines, Stamping Machines, Forging Machines, Shearing Machines and Brakes. This group represents those machines that perform the first operations on material in the line of production. The trimming operations have been differentiated from cutting operations such as are done on lathes, milling machines, shapers, etc. (see Group II). In general these machines prepare the work for those in Group II.

Adriance Machine Works, Inc.
Richards St., Brooklyn, N. Y.
Products: Foot and Hand Presses

Air Associates, Inc.
Roosevelt Field, Garden City, N. Y.
Personnel: F. Leroy Hill, Pres. & Gen. Mgr., H. I. Crow, V. Pres.
Products: Propeller Balancing Stands, Straightening Presses, Checking Tables, etc.

Ajax Electric Company, Inc.
(Div. Ajax Metal Co.)
Philadelphia, Pa.
Products: Industrial Furnaces

American Broach & Machine Co.
(Div. Sunstrand Machine Tool Co.)
Ann Arbor, Mich.
Products: Broaches, Broaching Machines, Hydraulic Presses

American Gas Furnace Co.
Elizabeth, N. J.
Products: Gas Furnaces

American Saw & Mfg. Co.
Springfield, Mass.
Products: Saws

Atlas Press Company
Kalamazoo, Mich.
Personnel: G. C. Nancarrow, Sales. Mgr.
Products: Presses

Ajax Electric Company, Inc.
Products: Lathes, Presses, Drilling Machinery, Shapers, etc.

The Baird Machine Co.
Bridgeport, Conn.
Personnel: Leon A. Warner, Pres. & Treas., & Gen. Mgr., B. C. Warner, V. Pres. & Pur. Agt.
Products: Wire Farming Machines, Presses, Multiple Spindle Lathes

Baldwin-Southwark Corp.
Philadelphia, Pa.
Personnel: Chas. E. Brinley, Pres., W. H. Harman, V. Pres. & Gen. Mgr.
Products: Hydraulic Presses, Power Mach. & Testing Equipment

Bardons & Oliver, Inc.
1133 W. 9th St., Cleveland, Ohio
Products: Turret Lathes, Cut-Off Machinery

Beach Manufacturing Co.
Montrose, Pa.
Personnel: G. R. McKeage, Pres. & Gen. Mgr., B. F. McKeage, V. Pres. & Treas.
Products: Saws (Tilting, Rip), Sanders, Boring Mach., Shapers, Mortisers, Jointers

Bellevue Industrial Furnace Co.
2971 Bellevue, Detroit, Mich.
Personnel: W. E. Hinz, Gen. Mgr.
Products: Melting & Heat Treating Furnaces

Beebe Brothers
Seattle, Wash.
Personnel: R. H. Beebe, Pres., D. D. Beebe, V. Pres., F. W. Beebe, Sec.
Products: Jig Saws, Hand Hoists

Bicknell-Thomas Company
Greenfield, Mass.
Personnel: Leon E. Turner, Pres. & Treas.
Products: Cutting Tools, Tapping Mach., Chucks

Billings & Spencer Co.
Hartford, Conn.
Personnel: W. A. Purtell, Pres. & Treas., W. Roy Moore, V. Pres. & Sec.
Products: Forging Machy. & Drop Forged Tools

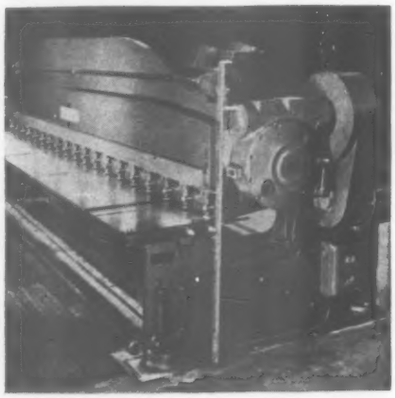
Birdsboro Steel Foundry and Machine Co.
Birdsboro, Pa.
Personnel: J. E. McCauley
Products: Presses, Special Equip. & Castings

Black Diamond Saw & Machine Works
Natick, Mass.
Products: Saws & Precision Drill Grinders

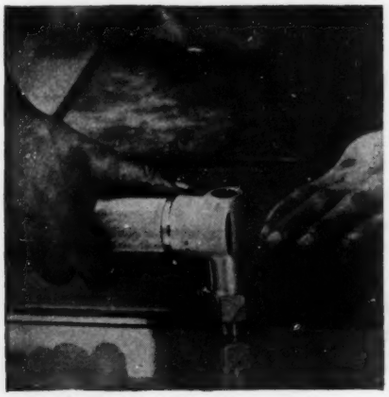
E. W. Bliss Company
53rd St. & 2nd Ave., Brooklyn, N. Y.
Products: Sheet Metal Working Machinery, Presses & Dies

Brown Machinery Company
2323 N. Ninth St., St. Louis, Mo.
Products: Lathes, Presses, Shears & Forming Rolls

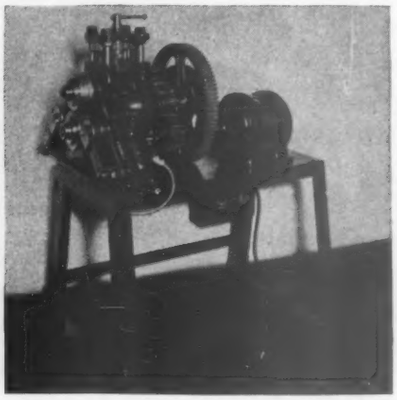
Hydraulic Stamping Machine—Chambersburg Engineering Company



Shearing Machine—The Cincinnati Shaper Company



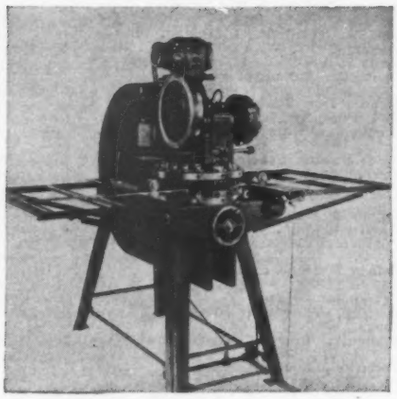
Hand Nibbler — Buckeye Portable Tool Company



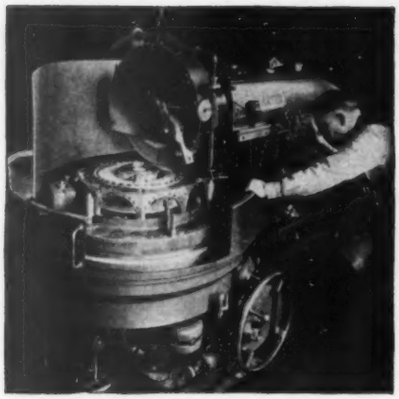
Electric Operated Forge—Buffalo Forge Company

Doall Model 26 Metal Master—Continental Machines Inc.

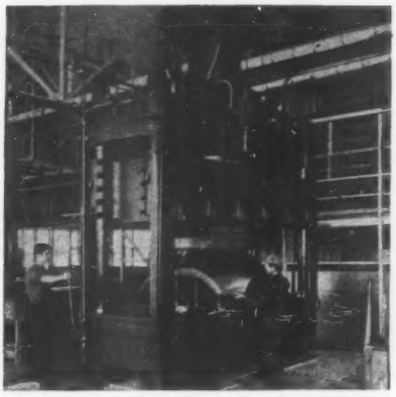
Rafter Press Brake — Ferracute Machine Company



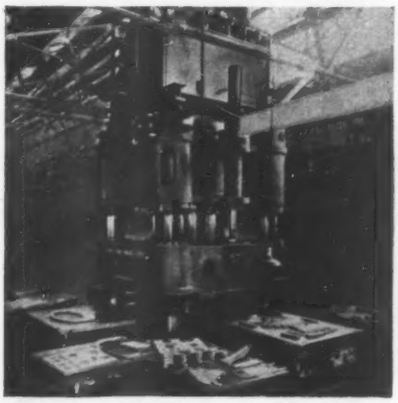
Type R41P Turret Punch Press—Weidermann Machine Co.



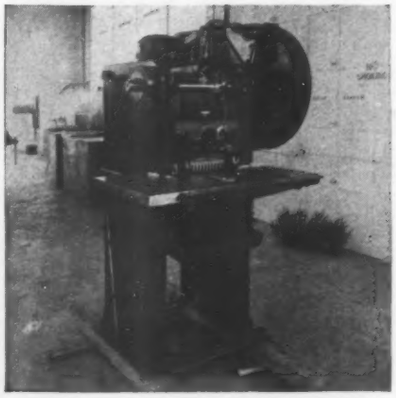
Rotary Surface Grinder — Arter Grinding Machine Co.



H-P-M Hydropower Fastraverse Press—Hydraulic Press Mfg. Co.



High Speed 2500 ton Forming Press—Lake Erie Engineering Corp.



Square Shear Machine—Northill Company, Inc.

Buffalo Forge Co.
Buffalo. N. Y.
Products: Forges, Heating & Ventilating Equip.

Andrew C. Campbell Company
(Div. Am. Chain & Cable)
Products: Abrasive Cutting & Nibbling Machines

Canedy-Otto Mfg. Co.
Chicago Heights, Ill.
Personnel: C. L. Hughes, Sales Mgr.
Products: Presses, Cranes, Surface Plates

Chambersburg Engineering Company
Chambersburg, Pa.
Personnel: Eugene C. Clarke, Pres. & Gen. Mgr., R. E. W. Harrison, V. Pres. & Gen. Sales Mgr., M. H. Ivins, Sec.
Products: Forging & Metal Working Machinery

Champion Blower & Forge Company
Lancaster, Pa.
Personnel: C. B. Long, Pres., E. Donohoe, V. Pres.
Products: Drills, Forges, Blowers, Shears, Punchers, Hammers, Presses, Saws, Lathes, Fans, Dies & Taps, Hack Saw & Thread Cutting Mach.

The Cincinnati Shaper Co.
Cincinnati, Ohio
Personnel: Perrin G. March, Jr., Pres., H. S. Robinson, Sec.
Products: Shapers, Press Brakes & Shears

Clearing Machine Corp.
6499 W. 65th St., Chicago, Ill.
Personnel: R. W. Glasner, Pres.
Products: Presses (all types)

Cochrane-Bly Company
St. James St., Rochester, N. Y.
Products: Millers, Shapers, Cutting & Filing Machines

Consolidated Machine Tool Corp.
Rochester, N. Y.
Products: Milling Machines, Lathes, Drills, Presses, etc.

Continental Machines, Inc.
Minneapolis, Minn.
Personnel: R. J. Wilkie, V. Pres.
Products: Sawing, Filing, Die Sinking Machines

Henry Disston & Son, Inc.
Philadelphia, Pa.
Personnel: Henry Disston, Pres., Wm. D. Disston, V. Pres., S. Horace Disston, V. Pres.
Products: Saws (all types)

Dries & Krump
Chicago, Ill.
Products: Brake Bending Machines

Earle Gear & Machinery Company
4723 Stenton Ave., Philadelphia, Pa.
Products: Sawing Machines

Chas. F. Elmes Engineering Works
Chicago, Ill.
Personnel: Charles W. Elmes, Pres., Charles F. Elmes, V. Pres.
Products: Metal Forming Presses

Engineering & Research Corp.
Riverdale, Md.
Personnel: H. A. Berliner, Pres., L. A. Wells, V. Pres.
Products: Hydraulic Presses, Propeller Profiles, Riveting Machines, Miscellaneous Metal Forming Machinery

Erie Foundry Company
Erie, Pa.
Products: Presses, Hammers, Forging Machinery, etc.

Ex-Cell-O Corporation
Detroit, Mich.
Personnel: Phil Huber, Pres. & Gen. Mgr.
Products: Grinders, Boring, Drilling, Broaching, Cutting Machines, Drilling Equipment & Diesel Fuel Injection Equipment

Excelsior Tool & Machine Company
East St. Louis, Ill.
Personnel: T. F. Philippi, Pres., E. Matter, Sec.
Products: Punch, Bending, Polishing & Shear Machines

Farrel-Birmingham Co., Inc.
Ansonia, Conn.
Personnel: N. W. Pickering, Pres. & Gen. Mgr., Carl Hitchcock, V. Pres., A. S. Redway, V. Pres.
Products: Forming Presses

Ferracute Machine Company
Bridgeton, N. J.
Personnel: G. E. Bass, Pres., H. A. Janvier, V. Pres., P. M. Meyers, Sec., L. C. Meyers, Gen. Mgr.
Products: Presses (all types)

Fox Machine Company
Jackson, Mich.
Products: Presses

Chas. E. Francis Company
Rushville, Ind.
Personnel: Geo. J. Friesser, Pres.
Products: Presses, Glue Pots, Mixers, Spreaders, Clamps, Coating & Painting Machines. Trucks

Gallagher Manufacturing Company
39 Norton St., Braintree, Mass.
Personnel: K. A. Gallagher, Sec.
Products: Shears

General Machinery Corporation
Hamilton, Ohio
Products: Presses & Miscellaneous Tools

Greenerd Arbor Press Co.
41 Crown St., Nashua, N. H.
Personnel: Warren L. Martin, Pres. & Gen. Mgr.
Products: Presses

Hall & Brown Machine Company
1915 N. Broadway, St. Louis, Mo.
Products: Nibblers, Presses, Sanders, Rip Saws

Hannifin Manufacturing Company
621 S. Kolmar Ave., Chicago, Ill.
Personnel: V. W. Peterson, Pres.
Products: Presses, Punchers, Riveters, Vises

The Henry & Wright Mfg. Company
Hartford, Conn.
Personnel: F. K. Simmons, Pres.
Products: Presses, Drilling Machines

Heston & Anderson
Fairfield, Iowa
Products: Jointers, Saws

Horn Device Manufacturing Co.
Kenmore, Ohio
Products: Power Band Saws

Hydraulic Press Mfg. Company
Mount Gilead, Ohio
Personnel: Howard F. MacMillin, Pres. & Gen. Mgr., W. C. Batchelor, Sec.
Products: Hydraulic Presses

Kane & Roach, Inc.
Syracuse, N. Y.
Personnel: H. W. Kane, Pres.
Products: Angle Benders, Forming Machines

James H. Knapp Co., Inc.
4920 Loma Vista Ave., Los Angeles, Calif.
Personnel: James H. Knapp, Pres.
Products: Forges, Furnaces (all types)

Lake Erie Engineering Corp.
374 Delaware Ave., Buffalo, N. Y.
Personnel: B. E. Dillon
Products: Presses, Riveters

La Salle Machine Works
Chicago, Ill.
Products: Punch Presses

Libert Machine Company
Green Bay, Wis.
Products: Shears

Logansport Machine Inc.
Logansport, Ind.
Personnel: O. W. Macy, Sales Mgr.
Products: Hydraulic Equipment, Pumps, Gages, Miscellaneous Equipment.

Loshbough Jordan Tool & Machine Co.
Elkhart, Ind.
Personnel: B. H. Jordan, Gen. Mgr.
Products: Presses

W. B. Mershon Co.
Saginaw, Mich.
Personnel: C. J. Marshall, Gen. Mgr.
Products: Sawing Machines

Milburn Co., The Alexander
1416-28 W. Baltimore St., Baltimore, Md.
Personnel: A. F. Jenkins, Pres.
Products: Welding & Cutting Apparatus, Paint Spray Equipment

George E. Moore
44 Farnsworth St., Boston, Mass.
Products: Presses

Morgan Engineering Co.
Alliance, Ohio
Products: Cranes, Hammers, Forging Presses

National Machinery Co., The
Tiffin, Ohio
Products: Presses, Forging Machines, Headers, Tappers

The National Tool Company
Cleveland, Ohio
Personnel: A. J. Brandt, Pres.
Products: Cutting Tools

National Twist Drill & Tool Co.
Detroit, Mich.
Personnel: E. J. Chamberlain, V. Pres.
Products: Twist Drills, Reamers, Hobs, Milling Cutters & Special Tools

Niagara Machine & Tool Works
637-97 Northland Ave., Buffalo, N. Y.
Products: Power Presses, Shears, Sheet Metal Machine Tools

John J. Normoyle Co.
Moline, Ill.
Products: Sheet Metal Shears

Northill Company, Inc.
Los Angeles, Calif.
Products: Crowners, Shears, Hydraulic Pumps

Peck, Stow & Wilcox Company
Southington, Conn.
Personnel: Mark J. Lacey, Pres. & Gen. Mgr.
Products: Shears, Brakes, Formers, Beading Machines and Presses

Henry Pels & Co., Inc.
90 West St., New York, N. Y.
Personnel: Curt L. Martin, Pres.
Products: Shearing & Punching Machines

Perkins Machine Co.
Warren, Mass.
Products: Presses

Pettingell Machine Co.
77 Elm .St. Amesbury, Mass.
Products: Power Hammers, Rotary Shears

C. O. Porter Machinery Co.
Grand Rapids, Mich.
Personnel: C. Oscar Porter, Pres., Clare O. Porter, V. Pres. & Treas.
Products: Cutter Grinders & Woodworking Machinery

H. K. Porter, Inc.
Everett, Mass.
Personnel: W. H. Porter, Pres., James G. Geddes, V. Pres.
Products: Cutting Machines & Bolt Clippers

Progressive Welder Company
737 Piquette, Detroit, Mich.
Products: Welding Equip. & Hydraulic Mach'y

The Quickwork Co.
Chicago Daily News Bldg., Chicago, Ill.
Products: Hammers, Rotary Shears

Racine Tool & Machine Co.
1774 State St., Racine, Wisc.
Personnel: M. E. Erskine, Pres., F. H. Kind, V. Pres.
Products: Metal Cutting Machines, Hydraulic Pumps

W. Robertson Machine & Foundry Co., Inc.
56 Rano St., Buffalo, N. Y.
Personnel: E. Lou Robertson, Pres., S. J. Robertson, V. Pres., M. R. Robertson, Sec., & Treas.
Products: Power Hacksaw Machines

Smith Welding Equipment Corp.
Minneapolis, Minn.
Personnel: E. H. Smith, Pres.
Products: Welding & Cutting Equipment

Stanley Electric Tool Division
(The Stanley Works)
New Britain, Conn.
Personnel: H. W. Blackman, Sales Mgr.
Products: Portable Electric Drills, Grinders, Saws, Screw Drivers, Shears

Steadfast & Roulston, Inc.
Boston, Mass.
Products: Hand Arbor Presses

Strong, Carlisle & Hammond
(Hammond Mfg. Co.)
1392 W. Third St., Cleveland, Ohio
Personnel: T. W. Carlise, Pres., G. J. Zimmerman, V. Pres., R. L. Keech, Sec.
Products: Industrial Furnaces

Sumner Iron Works
2411 First St., S., Everett, Wash.
Products: Swing Saws

F. J. Swaine Company
St. Louis, Mo.
Products: Punch Presses

Taylor & Fenn Company
Hartford, Conn.
Products: Presses, Grinders, Milling Machines

Toledo Machine & Tool Co.
Toledo, Ohio
Personnel: Harry H. Pinney, Pres., H. U. Herrick, V. Pres., Harold F. Smith, Sec. & Treas.
Products: Presses (Sheet Metal Working)

Torchweld Equipment Co.
1035 W. Lake St., Chicago, Ill.
Personnel: C. K. Anderson, Pres., J. C. Kirchner, V. Pres.
Products: Welding & Cutting Apparatus

The V. & O. Press Company, Inc.
Hudson, N. Y.
Personnel: T. I. Shriver, Pres., Herman Osswald, V. Pres., Herman F. Zorn, V. Pres.
Products: Power Presses, Special Equipment

Verson All Steel Press Co.
93rd St. & S. Kenwood Ave., Chicago, Ill.
Products: Presses

The Watson-Stillman Company
Roselle, N. J.
Products: Forcing Presses

Weaver Manufacturing Company
S. Ninth St., Springfield, Ill.
Products: Presses

Wellman Engineering Company
Cleveland, Ohio
Products: Hydraulic Presses

Baxter D. Whitney & Son, Inc.
Winchendon, Mass.
Products: Rip Saws, Spindle Shapers, Surfacers

Wickes Brothers
Saginaw, Mich.
Products: Lathes, Gang Saws, Blueprinting & Special Machinery

Wiedemann Machine Company
1815 Sedgley Ave., Philiadelphia, Pa.
Personnel: Theodore Wiedemann, Pres.
Products: Turret Punches

J. H. Williams & Company
Buffalo, N. Y.
Personnel: J. H. Williams, Pres,, A. D. Armitage, V. Pres.
Products: Cutting Tools, Files, Clamps

Yates-American Machine Co.
Beloit, Wis.
Products: Surfacers, Moulders, Shapers, Jointers, Saws, Sanders

Yoeder Company
Cleveland, Ohio
Products: Hammers

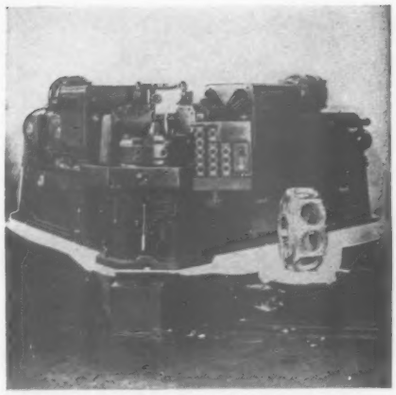
GROUP II—MACHINING OPERATIONS—contains the list of manufacturers of Lathes, Drills, Shapers, Milling Machines, Broaching Machines, Grinding Machines and other equipment that perform machining operations on the material. Machining operations in this group have been interpreted to mean those operations which are performed on the rough finished stock prior to such work as honing and polishing. Names that have previously appeared in the first group are referred back to their original listing.

The Acme Machine Tool Co.
Cincinnati, Ohio
Personnel: C. H. M. Atkins, Pres., B. B. Quillen, V. Pres., E. N. Atkins, Sec.
Products: Turret Lathes, Screw Machines

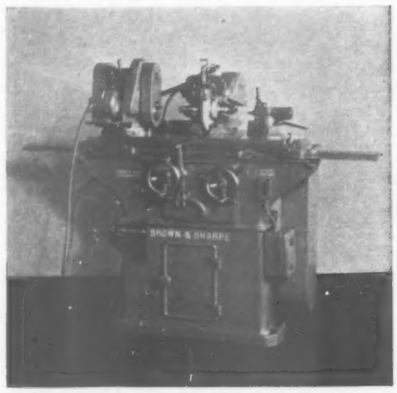
The Acme Machinery Co.
Cleveland, Ohio
Products: Rebuilt Machinery

The Adams Co.
Dubuque, Ia.
Personnel: Eugene Adams, Pres., Herbert Adams, Sec.
Products: Gear Hobbers, Thread Millers

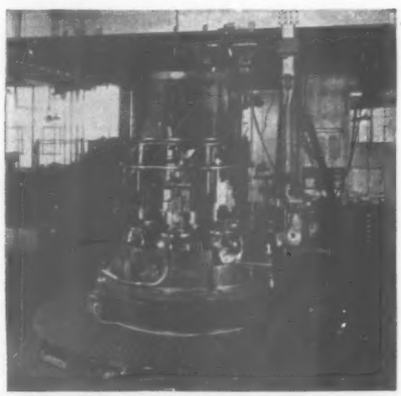
Aircraft Tool Supply Co.
1609 E. Slauson, Los Angeles, Calif.
Products: Portable Drills



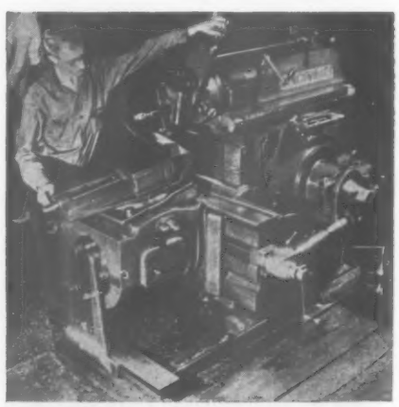
Angular Drilling Machine—Bausch Machine Tool Co.



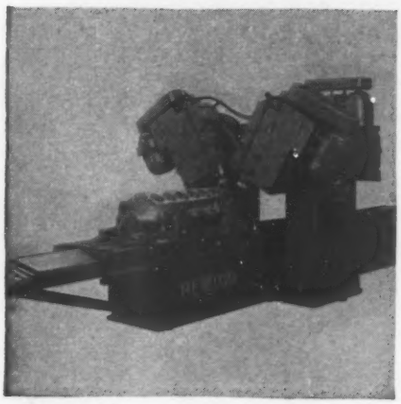
Universal Grinding Machine — Brown & Sharpe Mfg. Co.



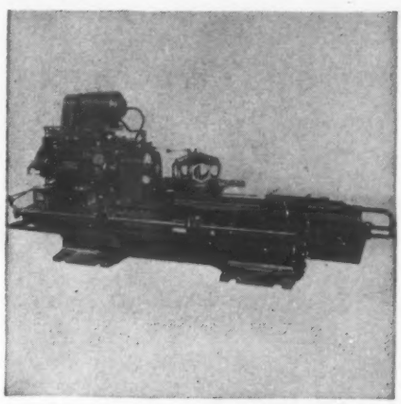
Spindle Type "D" Mult-Au-Matic Machine —The Bullard Company



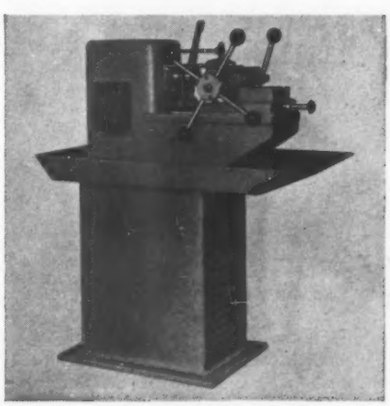
Shaping Machine—The Cincinnati Shaper Company



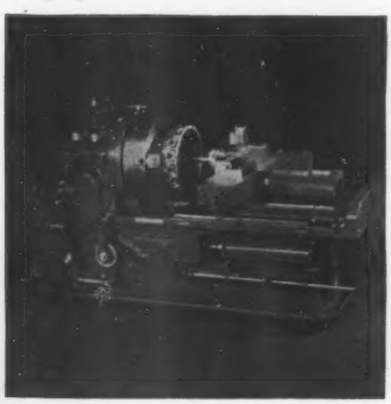
Mill-N-Shaver — Consolidated Machine Tool Corporation



Fastermatic Machine—Foster Machine Company



Threading Machine—The Geometric Tool Company



Platen Type Simplimatic Machine Lathe—Gisholt Machine Company

Albertson & Co.
Sioux City, Ia.
Personnel: H. A. Jacobson, Adv. Mgr.
Products: Valve Grinding Tools

Charles G. Allen
Barre, Mass.
Personnel: Charles G. Allen, Gen. Mgr.
Products: Drilling Machines and Drill Presses

American Broach & Machine Co.
(See Group 1)

The American Tool Works Co.
Cincinnati, Ohio
Personnel: J. C. Hussey, V. Pres. in charge Domestic Sales
Products: Lathes, Drills and Shapers

American Twist Drill & Tool Co.
2804 W. Jefferson St., Detroit, Mich.
Products: Drills

B. C. Ames Co.
Waltham, Mass.
Products: Milling & Drilling Mach.

Apex Broach Co.
Dayton, Ohio
Products: Stud Drivers & Setters

Armstrong Blum Mfg. Co.
Personnel: Harry Blum, Pres.
Products: Saws, Cutting, Shearing, Tapping, Punching Mach. & Vises

Armstrong Bros. Tool Co.
317 N. Francisco Ave., Chicago, Ill.
Products: Turret Lathes, Misc. Hand Tools & Tool Holders

Atlas Press Company (See Grou I)

The Automatic Machine Co.
Bridgeport, Conn.
Personnel: G. L. Sexton, Pres. & Gen. Mgr., James Coulter, V. Pres.
Products: Boring, Hobbing, Threading, Milling, etc., Machines

M. E. Avery Co.
Watertown, N. Y.
Products: Drilling Machines & Drill Presses, Attachments

Avey Drilling Machine Co.
Cincinnati, Ohio
Products: Drilling Machines

The Baird Machine Co. (See Group I)

Baker Brothers, Inc.
Toledo, Ohio
Personnel: William Baker, Pres., G. E. Hallenbeck, V. Pres. & Gen. Mgr.
Products: Tapping, Drilling, Keysetting Mach., Accessories

Baldwin-Southwark Corp. (See Group I)

Barber-Colman Co.
Rockford, Ill.
Products: Metal Cutting Mach. & Air Control Equip.

Bardons & Oliver, Inc. (See Group I)

W. F. and John Barnes Company
Rockford, Ill.
Products: Drilling, Precision Boring Mach., Hydr. Pumps, Controls

Barnes Drill Company
814-830 Chestnut St., Rockford, Ill.
Personnel: J. E. Andress, Pres. & Treas., A. M. Johnson, V. Pres., A. G. Block, Sec.
Products: Drilling & Honing Mach.

Bausch Machine Tool Co.
156 Wason, Springfield, Mass.
Products: Drill Presses

Bay State Tap & Die Co.
Mansfield, Mass.
Products: Taps & Tapping Equip.

Beach Manufacturing Co. (See Group I)

Bicknell-Thomas Company (See Group I)

Bignall & Keeler Machine Works
(Of the N. O. Nelson Mfg. Co.)
Edwardsville, Ill.
Products: Pipe Threading, Die Grinding Mach.

Bilgram Gear & Machine Works
Philadelphia, Pa.
Products: Gears & Cutters

Birdsboro Steel Foundry and Machine Co.
(See Group I)

Black & Decker Mfg. Co.
Towson, Md.
Personnel: S. Duncan Black, Pres., Alonso G. Decker, V. Pres. & Gen. Mgr.
Products: Drills, Grinders, etc.

Black Diamond Saw & Machine Works
(See Group I)

The Blanchard Machine Company
64 State St., Cambridge, Mass.
Products: Grinders, Grinding Wheels, Demagnetizers

J. G. Blount Company
Everett, Mass.
Products: Lathes & Attachments

Bodine Corporation
317 Mountain Grove St., Bridgeport, Conn.
Personnel: A. V. Bodine, Pres.
Products: Tapping, Drilling & Screw Driving Machinery

Boye & Emmes Machine Tool Co.
Cincinnati, Ohio
Products: Lathes

Brown-McLaren Mfg. Company
Detroit, Mich.
Products: Reamers & Screw Mach. Prod.

Brown Machinery Company (See Group I)

Brown & Sharpe Mfg. Company
Providence, R. I.
Personnel: H. D. Sharpe, Pres. & Treas., H. Buker, V. Pres. & Gen. Sales. Mgr.
Products: Machine Tools

Bryant Chucking Grinder Co.
Springfield, Vt.
Personnel: R. E. Flanders, Pres., W. J. Bryant, V. Pres., J. E. Stetson, Treas. & Mgr.
Products: Grinders

Buckeye Portable Tool Company
Dayton, Ohio
Products: Pneumatic & Portable Tools

Builders Iron Foundry
Providence, R. I.
Products: Grinders, Polishers, Metering & Controlling Equip.

The Bullard Company
Bridgeport, Conn.
Personnel: E. P. Bullard, Pres., E. C. Bullard, V. Pres., J. W. Bray, V. Pres. & Dir. Sales.
Products: Turret Lathes, Production Mach.

The Burke Machine Tool Co.
Conneaut, Ohio
Products: Drill Presses, Milling & Tapping Mach., Attachments

Buss Machine Works
Holland, Mich.
Personnel: M. Everett Dick, Pres., Eldon W. Dick, Sec.-Treas.
Products: Electric Woodworking Mach., Shapers

Cairns Metals Corporation
30 Broad Street, New York, N. Y.
Personnel: E. B. Cairns; Basil Learmont.
Products: Automatic Rolling Mach.

Andrew C. Campbell Company (See Group I)

The Carlton Machine Tool Company
Cincinnati, Ohio
Products: Radial Drills

R. L. Carter Div.
(The Stanley Works)
New Britain, Conn.
Products: Routers, Shapers, Planes, Mortisers

Cedar Rapids Eng. Co. of Del.
902-17th Street, N. E., Cedar Rapids, Iowa.
Personnel: R. H. Heister, Pres., T. M. Jones, V. Pres.
Products: Boring & Facing Mach., Grinders, Reseating Tools, Adapter Stands

Chambersburg Engineering Company
(See Group I)

Champion Blower & Forge Company
(See Group I)

Chicago Wheel & Mfg. Co.
1101 W. Monroe Street, Chicago, Ill.
Personnel: H. E. Miller, Pres., I. Danielson, V. Pres., A. T. Dalton, Sec.
Products: Electric Grinders & Lathe Wheels

The Cincinnati Bickford Tool Co.
Oakley, Cincinnati, Ohio
Products: Metal Drilling Machines (All types)

Cincinnati Electrical Tool Co.
2676 Madison Rd., Cincinnati, Ohio
Personnel: Charles E. Hahn, Sales Mgr.
Products: Grinders, Buffers, Drills, etc.

Cincinnati Gilbert Machine Tool
3360 Beekman St., Cincinnati, Ohio
Personnel: Charles Gilbert, Pres.
Products: Machine Tools

Cincinnati Lathe & Tool Co.
3207 Disney St., Oakley, Cincinnati, Ohio
Personnel: W. C. Heindel, Pres., J. S. Laird, V. Pres.
Products: Lathes & Machine Tools

Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Cincinnati, Ohio
Personnel: Frederick V. Geier, Pres., W. W. Tangeman, V. Pres.
Products: All Types of Milling Machines, Broaches, Lapping Machines & Grinders

The Cincinnati Planer Company
Cincinnati, Ohio
Products: Planers

The Cincinnati Shaper Co. (See Group I)

Cleereman Machine Tool Co.
Green Bay, Wisc.
Personnel: H. B. Cleerman, Pres.
Products: Drilling & Boring Machines

Cleveland Automatic Mch. Co.
Cleveland, Ohio
Personnel: W. F. Brown, Pres., A. L. Patrick, Exec. V. Pres.
Products: Turret Machines (All types)

Cleveland Hobbing Machine Co.
1170 E. 152nd St., Cleveland, Ohio
Personnel: W. H. Staples, Mgr.
Products: Hobbing Machines

Cleveland Pneumatic Tool Co.
3734 E. 78th St., Cleveland, Ohio
Personnel: L. W. Greve, Pres., H. W. Foster, V. Pres., A. F. Barner, Sec.
Products: Riveters, Sheet Holders, Air Drills, Grinders & Polishers

Cleveland Punch & Shear Works Company
Cleveland, Ohio

Cleveland Twist Drill Co.
1242 E. 49th St., Cleveland, Ohio
Personnel: J. E. Cox, Jr., Pres. & Gen. Mgr., S. H. Cox, V. Pres.
Products: Drills, Reamers, Counterbores, etc.

Cleveland Universal Jig Co.
13404 St. Clair Avenue, Cleveland, Ohio
Personnel: E. F. Batterman, Prod. Engr., F. H. Jeffs, Prod. Engr.
Products: Universal Drilling Jigs, Special Fixtures and Machines

The Cleveland Planer Company
Cleveland, Ohio
Products: Planing Machines

Cochrane-Bly Company (See Group I)

Colcord-Wright Machinery Co.
St. Louis, Mo.
Products: Lathes

Colonial Broach Company
Detroit, Mich.
Products: Broaches

Cone Automatic Machine Co.
Windsor, Vt.
Products: Automatic Screw Machines & Attachments

Consolidated Machine Tool Corp. (See Group I)

Continental Machines, Inc. (See Group I)

Jas. Coulter Machine Company
Bridgeport, Conn.
Personnel: Jas. Coulter, Pres.

The Crescent Machine Company
Leetonia, Ohio
Products: Woodworking Machines, Grinders, Lathes, Shapers, etc.

Davis Boring Tool Division
(Larkin Packer Company, Inc.)
6200 Maple Avenue, St. Louis, Mo.
Personnel: J. J. Larkin, Sr., Pres., W. H. Larkin, V. Pres., J. J. Larkin, Jr., Sec.
Products: Boring Tools & Reamers

The Delta Mfg. Company
Milwaukee, Wisc.
Personnel: J. E. Tautz, Pres., R. C. Beck, V. Pres., M. Doule, Sec.
Products: Drill Presses, Woodworking Machines

Detroit Boring Bar Co.
690 E. Fort St., Detroit, Mich.
Products: Boring & Reamer Bars & Cutters

Detroit Broach Co.
Detroit, Mich.
Products: Broaches

De Vlieg Machine Company
Detroit, Mich.
Personnel: Mr. De Vlieg, Pres.

Diamond Machine Company
9 Codding St., Providence, R. I.
Products: Grinders

Dumore Company
Racine, Wisc.
Products: Portable Flexible Shaft Tools (All types)

Duro Metal Products Co.
2649-59 N. Kildare Ave., Chicago, Ill.
Personnel: W. H. Odlum, Pres.
Products: Machine Tools, Drill Presser

Eastern Machine Screw Corp.
New Haven, Conn.
Personnel: B. P. Greene, Pres. & Gen. Mgr., C. W. Bettcher, V. Pres., T. W. Ryley, Sec.
Products: Die Heads & Threading Machines

Eclipse Counterbore Company
7410-30 St., Aubin Ave., Detroit, Mich.
Personnel: R. G. Michell, Gen. Mgr.
Products: Boring and Counterboring Machines, Miscellaneous Cutting and Drilling Equipment

Elgin Tool Works
1770 W. Berteau, Chicago, Ill.
Products: Bench Lathes

Elliott & Stephens
St. Louis, Mo.
Products: Lathes

Engineering & Research Corp. (See Group I)

Etna Machine Company
Toledo, Ohio
Personnel: N. D. Abbey, Pres. & Mgr., L. B. Byers, Sec.-Treas.
Products: Welded Tube Machinery, Swaging Machines

Ex-Cell-O Corporation (See Group I)

Excelsior Tool & Machine Company
(See Group I)

J. A. Fay & Egan Company
Oakley, Cincinnati, Ohio
Products: Woodworking Machinery

The Fellows Gear Shaper Company
Springfield, Vt.
Personnel: E. R. Fellows, Pres. & Gen. Mgr., W. D. Woolson, V. Pres., E. J. Fullam, Sec.
Products: Gear Shapers, Cutting, Finishing & Inspection Machines

The R. Y. Ferner Company
161 Devonshire St., Boston, Mass.
Products: Boring, Drilling, Routing & Testing Machines

Fitchburg Grinding Mach. Corp.
67 Walnut St., Fitchburg, Mass.
Products: Grinders

The Flather Company
Nashua, N. H.
Products: Engine Lathes

The Foote-Burt Company
13010 St. Clair, Cleveland, Ohio
Personnel: T. H. Doan, Pres., W. F. Babcock, V. Pres., R. E. Delamater, V. Pres.
Products: Drilling Machines & Presses

Fosdick Machine Tool Company
Cincinnati, Ohio
Products: Drilling & Tapping Machines

Foster Machine Company
Elkhart, Indiana
Personnel: Mr. Foster, Pres., H. H. Moore, Gen. Mgr.
Products: Turret Lathes, Screw Machines, Chucking Machines & Equipment

The Gairing Tool Company
Detroit, Mich.
Personnel: B. O'Meara, Mgr. of Sales
Products: Counterbores, Countersinks, Drills, Reamers and Miscellaneous Equipment

Gallmeyer & Livingston Company
Grand Rapids, Mich.
Personnel: Chas. H. Gallmeyer, Pres., S. Owen Livingston, V. Pres., J. DeKoning, V. Pres., B. C. Saunders, Sec.
Products: Grinders (All types)

Gammons-Holman Company
Manchester, Conn.
Personnel: S. L. Gammons, Pres., M. G. Fitch, Sec.
Products: Reamers and Millers

Gardner Machine Company
Beloit, Wisc.
Personnel: Mr. Thompson, Pres.
Products: Grinders, Abrasive Discs & Wheels, Polishing Lathes

Garrison Machine Works, Inc.
Dayton, Ohio
Products: Gear Chucks, Gear Tooth Grinding

Gaterman Mfg. Company
Manatowoc, Wisc.
Products: Tapping Machines

Gear Grinding Machine Company
Detroit, Mich.
Products: Grinders

Genesee Manufacturing Company
Rochester, N. Y.
Products: Inserted Blade Hollow Mills

The Geometric Tool Company
New Haven, Conn.
Personnel: J. W. Hook, Pres., J. W. Sneyd, V. Pres.
Products: Threading Machines, Taps, Cutting Tools, Die Heads

Gisholt Machine Company
Madison, Wisc.
Personnel: H. S. Johnson, Pres., C. H. Johnson, G. H. Johnson & G. L. McMullen, V. Presidents
Products: Lathes (all types), Grinders, Balancing Machines & Misc. Tools

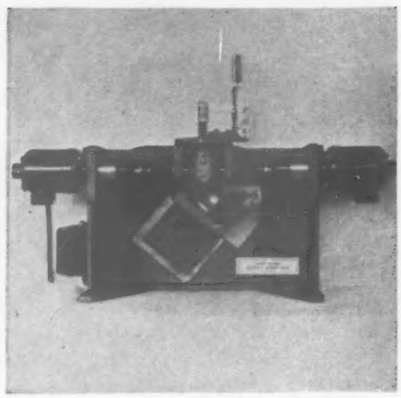
George Gorton Machine Company
Racine, Wisc.
Personnel: George Gorton, III, V. Pres., George Gorton, Pres., C. E. Erlandson, Sec.
Products: Milling & Profiling Machines, Die duplicates

Goss & Deleeuw Machine Company
New Britain, Conn.
Products: Chucking Machines

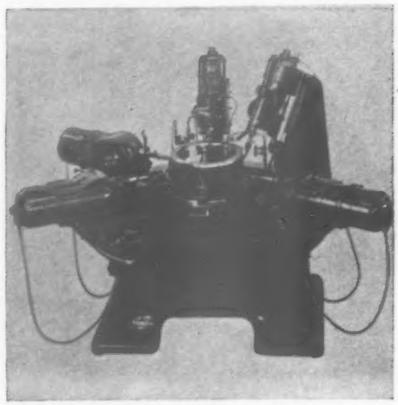
Gould & Eberhardt
Newark, N. J.
Products: Milling, Shaper & Hobbing Machines

Govro-Nelson Company
1931 Antoinette, Detroit, Mich.
Personnel: Victor Gauvreau, Pres.
Products: Drilling Machines

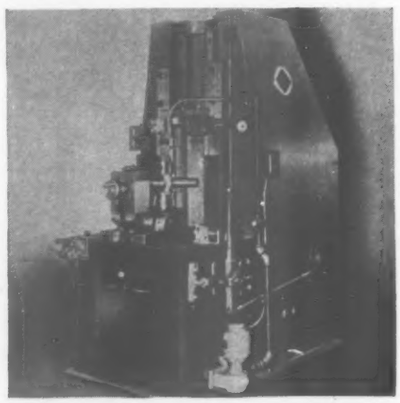
Grand Gear Works
Boston, Mass.
Personnel: J. J. Lannon, Pres. & Mgr.
Products: Gear Cutting Machines



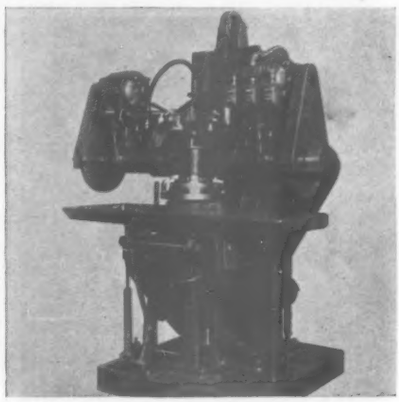
Tandem Drill—Govro-Nelson Company



Multiple Drill — Kingsbury Machine Tool Corporation



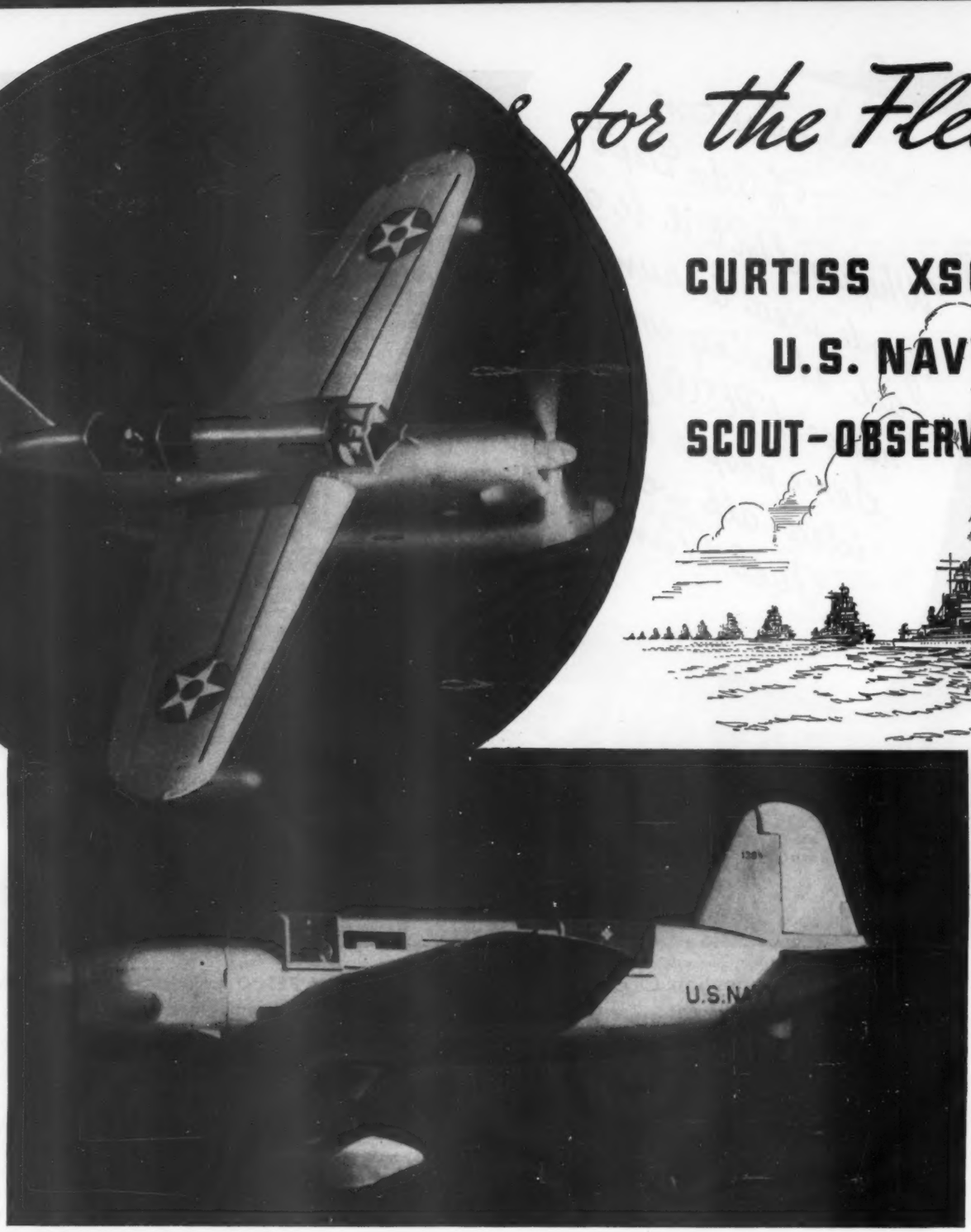
Vertical Broacher—La Pointe Machine Tool Company



No. 22 Milling Machine—Moline Tool Company

for the Fleet

CURTISS XSO3C-1
U.S. NAVY
SCOUT-OBSERVATION



The new Curtiss XSO3C-1 Scout-Observation Plane designed for the United States Navy is unusually fast for its type with an extended cruising range which gives it added value in accomplishing its duties as "The Eyes of the Fleet".

Designed for use aboard battleships and cruisers of the U. S. Navy, the Curtiss XSO3C-1 is a mid-wing monoplane powered by a 12-cylinder inverted "V" Type Ranger air-cooled engine. It carries a crew of two and can be interchangeably equipped as either a landplane or with floats as a seaplane.

Curtiss has for many years been an outstanding builder of observation aircraft. At present, planes of the Curtiss SOC type are in service aboard every battleship and cruiser of the United States Navy.

CURTISS AEROPLANE DIVISION
CURTISS-WRIGHT CORPORATION
Buffalo *New York*
"The Pioneers of Aviation"

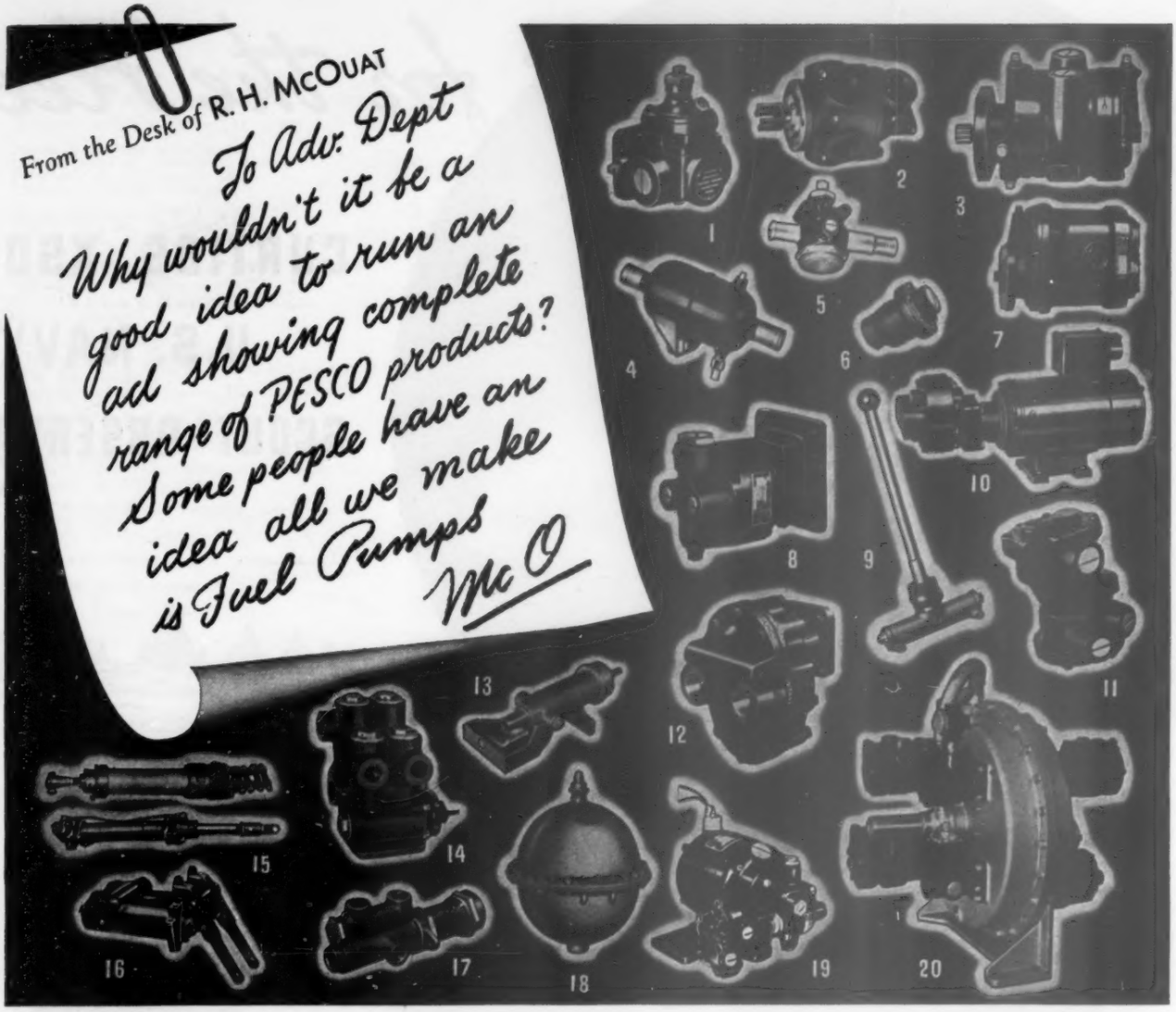
Curtiss PRECISION-BUILT ARMY AND NAVY AIRCRAFT

From the Desk of R. H. McOUAT

To Adv. Dept

Why wouldn't it be a good idea to run an ad showing complete range of PESCO products? Some people have an idea all we make is Fuel Pumps

McO



THANKS for the suggestion. Of course we can't show all of them (there are more than 400 separate items) but here is a representative selection of Pesco products. The number of new items included in this selection will indicate the extent of Pesco's unusual facilities for creating new accessories to meet special requirements—one of many reasons why more and more Pesco products are being specified as standard equipment on private, commercial and military aircraft the world over.

● A partial list of PESCO products that are helping to make flying safer and faster . . .

1. Fuel Pump with diaphragm type relief valve and by-pass.
2. Fuel Valves for all requirements.
3. Vacuum Pump for instruments and De-icers.
4. Oil Separator—new, more efficient design.
5. Relief Valve for suction regulation.
6. Check Valve for Vacuum Pump installations.
7. Dry Air Pump for instruments and De-icers.
8. Hydraulic Pump with integral relief valve.
9. Hand-Operated Hydraulic Pump.
10. Electric-Motor-Driven Hydraulic Pump for propeller feathering.
11. Hydraulic-Motor-Driven Fuel Pump.
12. Gear type Hydraulic Motor.
13. Hydraulic Locks for retractable landing gear.
14. Hydraulic Control Valves—all types.
15. Hydraulic Cylinders for retractable landing wheels, flaps, etc.
16. Hydraulic Power-Brake Valve.
17. Hydraulic Pressure Unloading Valves.
18. Hydraulic Pressure Accumulator.
19. Propeller Anti-Icing Pump.
20. Accessory Drive Gear Box with Pumps.

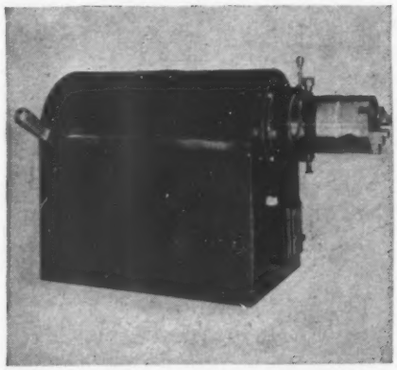
PESCO

PUMP ENGINEERING SERVICE CORPORATION

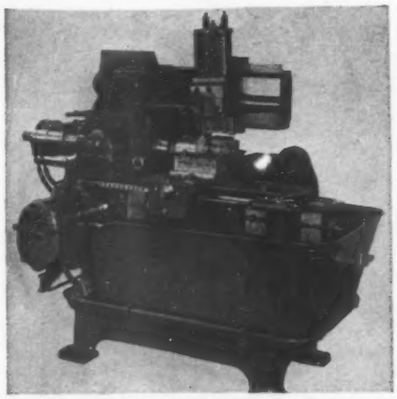
DIVISION BORG-WARNER CORPORATION

12910 TAFT AVENUE CLEVELAND, OHIO, U. S. A.

Doublehead Crankpin Grinder—Norton Company



Variable Speed Lathe—Schauer Machine Company



Automatic Lathe—Sundstrand Machine Tool Company

Paint Sprayer and equipment—Binks Manufacturing Company

Grand Mfg. & Machine Company
Bridgeport, Conn.
Products: Drilling Machines

The G. A. Gray Company
3611 Woodburn Ave., Cincinnati, Ohio
Products: Milling & Planing Machines

Greaves-Klusman Tool Company
Cincinnati, Ohio
Products: Engine Lathes

Grob Brothers
Grafton, Wisc.
Products: Die Making, Filing Machines, Saws

Hall & Brown Machine Company (See Group I)

Hall Manufacturing Company
Toledo, Ohio
Personnel: E. A. Hall, Pres. & Gen. Mgr., G. A. Powers, Sec.-Treas.
Products: Valve Seat Grinders, Cylinder Hones

The Hall Planetary Company
Philadelphia, Pa.
Personnel: P. Hall, Pres.
Products: Planetary Milling Machines

Hanchett Manufacturing Co.
Big Rapids, Mich.
Personnel: A. K. Hanchett, Pres.
Products: Surface Grinders

Hanson-Whitney Machine Company
Hartford, Conn.
Products: Taps, Threading Millers & Acces.

Harding Brothers, Inc.
Elmira, N. Y.
Personnel: D. G. Anderson, Pres., L. R. Evans, & D. R. Laux, V. Presidents
Products: Precision Machines

Harron Rickard & McCone Company
San Francisco, Calif.
Products: Milling Machines

R. G. Haskins Company
615 S. California Ave., Chicago, Ill.
Personnel: R. G. Haskins, Pres.
Products: Portable Flexible Shaft Machinery & Equipment

The Heald Machine Company
Worcester, Mass.
Products: Precision Grinding, Boring Machines

The Henry & Wright Mfg. Company (See Group I)

Hendey Machine Company
105 Summer St., Torrington, Conn.
Products: Engine Lathes, Crank Shapers, Centering Machines

High Speed Hammer Co., Inc.
Rochester, N. Y.
Personnel: Victor Brook, V. Pres.
Products: Riveters, Drilling & Tapping Machines

The Hisey-Wolf Machine Company
Cincinnati, Ohio
Products: Electric Drills, Grinders, Buffers

Hjorth Lathe & Tool Company
12 Beacon Street, Woburn, Mass.
Personnel: Henrick J. Hjorth, Pres. & Gen. Mgr.
Products: Bench Lathes, Gages and Attachments

Ideal Machinery Company
Plainville, Conn.
Products: Engine Lathes

Imperial Brass Mfg. Company
Chicago, Ill.
Personnel: Frank McNellis, Pres., J. T. Greenlee, Sales Mgr., Chg. of Aero. Products
Products: Tube Cutter, Benders

Independent Pneumatic Tool Company
600 W. Jackson Blvd., Chicago, Ill.
Personnel: N. C. Hurley, Pres., G. H. McCrae, F. B. Hamerly and W. A. Nugent, V. Presidents
Products: Portable Electric & Air Tools

Ingersoll Milling Mach. Co.
Rockford, Ill.
Products: Milling Machines

Ingersoll-Rand Company
Phillipsburg, N. J.
Personnel: D. C. Keefe, Pres., W. R. Grace, V. Pres.
Products: Riveters, Wire Benches, Drills, Clipping Hammers, Air Compressors, Pumps

Charles L. Jarvis Company
Middletown, Conn.
Personnel: R. Wetzel, V. Pres.
Products: Flexible Shaft Power Drivers Tools, Taps and Tapping Attachments, Chucks

Jones & Lamson Machine Company
Springfield, Vt.
Personnel: R. E. Flanders, Pres., K. H. Woolson, V. Pres. & Gen. Mgr., J. E. Lovely, V. Pres.
Products: Lathes, Millers, Grinders, Automatic Dies, Optical Inspection Instruments

Jones-Motrola Sales Company
432 Fairfield Avenue, Stamford, Conn.
Products: Drills

Kearney & Trecker Corporation
Milwaukee, Wisc.
Personnel: Theodore Trecker, Pres., J. L. Trecker, V. Pres., O. W. Carpenter, Sec. & Treas.
Products: Millers, Cutters, Grinders & Equipment

Kelly Reamer Company
Cleveland, Ohio
Products: Boring & Reaming Bars

Kent-Owens Machine Company
958 Wall Street, Toledo, Ohio
Personnel: W. J. Donkel, Pres. & Gen. Mgr., W. S. Rohr, V. Pres., E. G. Schill, V. Pres.
Products: Milling & Special Machinery

W. B. Knight Machinery Company
3920 W. Pine Blvd., St. Louis, Mo.
Products: Milling, Boring Machines

Kingsbury Machine Tool Corp.
Keene, N. H.
Personnel: E. J. Kingsbury, Pres. & Treas., G. Swahnberg, V. Pres.
Products: Drilling, Tapping, Indexing Machines, Adapter Units

Landis Tool Company
Waynesboro, Pa.
Products: Threading Machines, Taps, Grinders

Langelier Mfg. Company
Providence, R. I.
Products: Semi-Automatic Drills

La Pointe Machine Tool Co.
Hudson, Mass.
Products: Broaches

R. K. LeBlond Machine Tool Co.
Cincinnati, Ohio
Personnel: R. K. LeBlond, Pres., W. F. Green, V. Pres., H. C. Pierle, Sec.
Products: Lathes

The Lees-Bradner Company
Cleveland, Ohio
Personnel: H. T. Bradner, Pres.
Products: Hobbers, Millers, Grinders, Testers, Generators

Lehmann Machine Company
Chouteau & Grand Blvd., St. Louis, Mo.
Products: Engine Lathes

Leland-Gifford Company
Worcester, Mass.
Personnel: W. H. Leland, Pres., S. Nickoloff, V. Pres.
Products: Drilling Machines

W. C. Lipe, Inc.
Syracuse, N. Y.
Products: Lathes, Gen. Tooth Clamping Machines, Reamers

Lodge & Shipley Mach. Tool Co.
Cincinnati, Ohio
Personnel: M. G. Lodge, Pres., J. Wallace Carrel, V. Pres. & Gen. Mgr.
Products: Lathes

Lovejoy Tool Company
Springfield, Vt.
Personnel: F. P. Lovejoy, Pres.
Products: Cutting, Boring Tools

Lucas Machine Tool Company
523 E. 99th St., Cleveland, Ohio
Personnel: H. M. Lucas, Pres.
Products: Boring Mills

Madison Mfg. Co.
Muskegon, Mich.
Products: Boring, Reamer Bars

McGill Mfg. Co.
Valparaiso, Ind.
Products: Reamers, Boring Bars, Milling Cutters, Tool Posts

Manning, Maxwell & Moore
100 E. 42nd St., New York, N. Y.
Products: Drilling Machines

Mattison Machine Works
Rockford, Ill.
Personnel: A. M. Mattison, Pres., C. L. Mattison, V. Pres., Alan C. Mattison, Sec.
Products: Grinding Machinery

Michigan Tool Company
7171 E. McNichols Rd., Detroit, Mich.
Products: Hobs, Milling Cutters, Forming Tools & Special Machinery

Millersburg Reamer & Tool Co.
Millersburg, Pa.
Products: Reamers

Millers Falls Company
Greenfield, Mass.
Personnel: Philip Rogers, Pres., John R. Smead, V. Pres., G. U. Hatch, V. Pres.
Products: Electric Drills & Screw Drivers

Minster Machine Co.
Minster, Ohio
Products: Drilling Machines

Mitts & Merrill
Saginaw, Mich.
Personnel: M. H. Stimson, Pres.
Products: Keyseaters

Moline Tool Company
Moline, Ill.
Personnel: C. R. Rosborough, Pres.
Products: Drilling, Boring, Honing, Tapping, Special Machines

Monarch Machine Tool Co.
Sidney, Ohio
Personnel: W. E. Whipp, Pres., F. D. Dull, V. Pres.
Products: Lathes (All types)

Morris Machine Tool Co.
Cincinnati, Ohio
Products: Drilling Machines

Muchey Machine & Tool Co.
952 Porter St., Detroit, Mich.
Products: Grinders

Mummert-Dixon Co.
Hanover, Pa.
Personnel: E. S. Mummert, Pres. & Gen. Mgr. L. W. Rohrbaugh, V. Pres.
Products: Grinders, Patern Making Machinery

National Broach & Machine Co.
11455 Shoemaker, Detroit, Mich.
Personnel: M. Schultz, Treas.
Products: Gear Machines, Measuring Instruments & Broaching Tools

National Automatic Tool Co.
Richmond, Indiana
Personnel: H. W. Bockhoff, Pres.
Products: Drilling, Boring, Tapping Machines

National Machine Tool Co.
2272 Spring Grove Ave., Cincinnati, Ohio
Products: Tools

National Machinery Co., The (See Group I)

National Twist Drill & Tool Co. (See Group I)

New Advance Machinery Co.
Van Wert, Ohio
Products: Wood Shapers, Electric Glue Pots

Newark Gear Cutting Machine Co.
69 Prospect St., Newark, N. J.
Products: Gear Cutting Machines

New Britain-Gridley Machine Division
(The New Britain Machine Co.)
New Britain, Conn.
Personnel: H. H. Pease, Pres., E. I. Steinle, V. Pres. & Sls. Mgr., D. H. Montgomery, V. Pres.
Products: Chucking, Screw, Tube Machines

Niagara Machine & Tool Works (See Group I)

Nielsen, Inc.
Lawton, Mich.
Personnel: W. W. Gairing, Mgr.
Products: Grinders, Other Tools

Niles-Bement-Pond Company
(Pratt & Whitney Div.)
Hartford, Conn.
Personnel: C. R. Burt, Pres. & Gen. Mgr.
Products: Drills, Grinders, Lathes, Measuring Devices, Attachments.

Norton Company
Worcester, Mass.
Products: Grinding, Lapping Machines, Abrasives

The Oilgear Company
1301-1417 W. Bruce St., Milwaukee, Wisc.
Products: Oilgear Broaches

Oesterlen Machine Company
8301 Colerain, Cincinnati, Ohio
Products: Grinders, Milling Machines

Oliver Instrument Co., Inc.
Adrian, Mich.
Personnel: E. C. Oliver, Pres.
Products: Grinders, Die Making Machines

Oliver Machinery Company
Grand Rapids, Mich.
Personnel: M. D. Baldwin, Pres., H. B. Tuthill, V. Pres.
Products: Saws, Planers, Jointers, Routers, Sanders, Milling Machines & Special Machines

Onsrud Machine Works, Inc.
Chicago, Ill.
Products: Routers, Shapers, Grinders, Industrial Motors

Oster Manufacturing Co.
2057 E. 61st St., Cleveland, Ohio
Personnel: R. B. Tewksbury, Pres., Roger Tewksbury, V. Pres., A. S. Gould, Sec.
Products: Power Machinery, Threaders, Hand Tools

Peck, Stow & Wilcox Company (See Group I)

Peerless Machine Company
1615 Racine St., Racine, Wisc.
Products: Pipe Threading & Metal Sewing Machines

C. O. Porter Machinery Co. (See Group I)

Potter & Johnston Mch. Co.
Pawtucket, R. I.
Personnel: N. R. Earle, V. Pres.
Products: Lathes, Chucking & Turning Machines

Procunier Safety Chuck Co.
18 S. Clinton St., Chicago, Ill.
Products: Tapping Machines, Chucks, Threading Machines

Providence Eng. Works, Inc.
Providence, R. I.
Personnel: Wm. A. Drewett, Pres., R. H. Dunbar, V. Pres., M. G. Jackson, Sec.
Products: Drilling Machines

Reed-Prentice Corporation
Worcester, Mass.
Personnel: R. L. Thompson, Pres., F. W. McIntyre, V. Pres.
Products: Lathes, Routers, Milling, Jig Boring, Die Casting and Sinking Machines. Plastic Injection Moulding Machines

Reisinger Mfg. Company
841 Lake Ave., Rochester, N. Y.
Personnel: George Reisinger, Gen. Mgr.
Products: Adjustable Hollow Mills

Reliance Machine Sales Co.
Pittsburgh, Pa.
Products: Drills

Rickers-Shafer Co.
Erie, Pa.
Products: Thread Chasers, Tapping Machines

Rivett Lathe & Grinder, Inc.
Brighton, Boston, Mass.
Products: Lathes, Grinders, Collets, Chucks, Oil Lubrication Systems

Rockford Drilling Machine Division
(Borg Warner Corp.)
Rockford, Ill.
Products: Drilling, Boring, Tapping Machines, Clutches

Rockford Machine Tool Co.
Rockford, Ill.
Personnel: H. B. Norton, Pres., P. S. Jackson, Asst. Gen. Mgr.
Products: Shapers, Planers, Lathes

Rowbottom Machine Co., Inc.
Waterbury, Conn.
Personnel: Geo. Rowbottom, Pres.
Products: Cam, Milling and Grinding Machines

Ruthman Machinery Co.
200-250 Pike St., Cincinnati, Ohio

Joseph T. Ryerson & Son, Inc.
16 & Rockwell Sts., Chicago, Ill.
Products: Drilling Machines

W. J. Savage Co.
Knoxville, Tenn.
Personnel: J. H. Murrian, Pres., J. A. Murrian, V. Pres. & Gen. Mgr.
Products: Nibbling Machines

Schauer Machine Company
2060 Reading Rd., Cincinnati, Ohio
Products: Variable Speed Lathes

George Scherr Company
128 Lafayette St., New York, N. Y.
Products: Hobbers, Lathes, Millers, Grinders, Testing & Measuring Machines

Scully-Jones
Chicago, Ill.
Products: Counterbores

Sebastian Lathe Company
Cincinnati, Ohio
Products: Lathes, Tools

William Sellor & Company, Inc.
1600 Hamilton St., Philadelphia, Pa.
Products: Drill Grinders, Boring, Drilling and Planing Machines

Seneca Falls Machine Co.
Seneca Falls, N. Y.
Personnel: M. A. Coolidge, Pres., E. R. Smith, V. Pres. & Gen. Mgr.
Products: Lathes, Automatic Work Handling Equipment

Sheldon Machine Co.
Chicago, Ill.
Products: Shapers, Drill Press, Milling Machines, Lathes and Vises

Sibley Machine Foundry Corp.
South Bend, Indiana
Products: Drilling Machines

Sidney Machine Tool Co.
Sidney, Ohio
Personnel: F. J. Fields, Gen. Mgr.
Products: Tools

Skilsaw, Inc.
Chicago, Ill.
Personnel: E. W. Ristu
Products: Portable Electric Tools, Drill Stands, Grinders

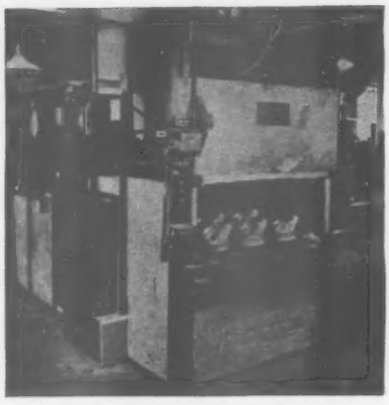
J. T. Slocomb Company
Providence, R. I.
Products: Counterbores

H. B. Smith Machine Company
Smithville, N. J.
Personnel: E. J. Smith, Pres., A. H. Howe, V. Pres.
Products: Woodworking Machines, Sanders

The Smith & Mills Company
Cincinnati, Ohio
Products: Shapers

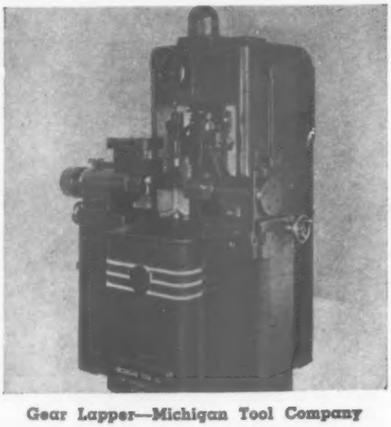
J. E. Snyder & Son
Worcester, Mass.
Products: Drill Presses

South Bend Lathe Works
425 E. Madison St., South Bend, Indiana
Products: Lathes (All types)

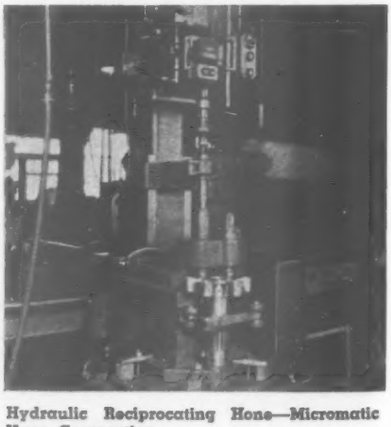


Heat Treating Oven—The Gehnrich Corporation

Tempering Furnace — Leeds & Northrup Company



Gear Lapper—Michigan Tool Company



Hydraulic Reciprocating Hone—Micromatic Hone Corporation

Daily, busy executives flying in SPARTAN ***Executives*** are making trips heretofore impossible, reaching prospects and clients easily in a few hours. Trips that formerly would have taken days spent in tiresome travel. The owner of an ***Executive*** is not limited by time tables, he makes his own schedules and its operating economy proves ownership of a SPARTAN ***Executive*** a wise investment. Inquiry on your letterhead will bring the facts on how to get more hours in each business day—*It's fun to FLY THERE!*

Inquiries invited from responsible people, interested in dealerships still available.

SPARTAN AIRCRAFT COMPANY
TULSA, OKLAHOMA

SPARTAN ALL METAL *Executive*

The Birdmen's Perch

Shortly after this appears, that original commercial flyer, St. Nick, will be banking in from the North Pole with a full pay load. In tune with the season, we want to say "Merry Christmas" and "Thanks for your letters" to all our 1939 contribs. And maybe toss in a hint along with our greetings to the rest—including a few old correspondents who must have lost their pencils—that we'd like to start 1940 out right with a Whopper, puzzle answer, or plain old-fashioned letter from you. Happy Landings!

"Tattered Wing-Tips," Ed., The Birdmen's Perch, Room 3800, Gulf Building, Pittsburgh, Pa.

LEXICOGRAPHER'S CORNER

The other day we had a letter from Ivan Daggitt of Benton Harbor, Mich. Said Ivan:

"The available definition of *electricity* is 'an imponderable and invisible agency, capable, under different circumstances, of producing light, heat, chemical decomposition, and other physical phenomena'."

What Ivan wants to know . . . since *electricity* is so hard to define . . . is anyone able to supply a good definition of the *aviation bug*? The one that bites people about two minutes after their first take-off.

Let's have your ideas, chums. We've been wondering for more years than we like to mention just what the critter does look like.

POSER

Here's a problem that put four of our smartest friends in straight jackets. Like last month's, it's from J. L. Centanni of New Orleans. Thanks again, J. L. Thanks also to Edward Bybel of Bayonne, N. J., who sent in the same puzzle just a few days later.

A pilot had a certain number of quart cans of Gulfpride Oil (advt.). He divided them among four mechanics as follows:

Mechanic A received ½ the quart cans plus a pint

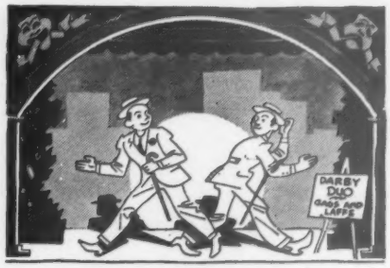
Mechanic B received ½ the remainder plus a pint

Mechanic C received ½ the remainder plus a pint

Mechanic D received one quart can

No opening of the cans was involved. How many cans did he have?

(T.W.T. is convinced that this is one of the trickiest problems printed in the Perch. So we're going to print an Honor Roll of those who get it. Send in your answer right away.)



THAT-WAS-NO-LADY DEPT.

One of the hardest things to pay attention to is an old story. Even if the boss is telling it.

But there's one story we've been telling now for ten years and which, in the interest of flyers generally as well as ourselves, we think is worth repeating for ten more. It's the story of what the Alchlor Process does to Gulfpride Oil that makes it like no other oil in the world.

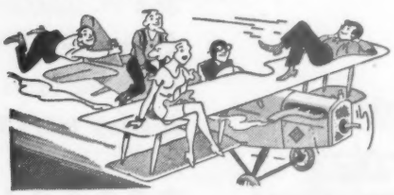
You see, the Alchlor Process is not just an ordinary refining step. It's a Gulf-invented refining miracle—*used in addition to conventional methods*—that digs up to 20% more carbon-and-sludge formers out of the 100% Pure Pennsylvania . . . makes Gulfpride the world's finest motor oil for planes.

THIS MONTH'S WHOPPER

Dear T.W.T.

I intended charging you $75 for misrepresentation of your Gulf Aviation Gas which resulted in the eradication of my antedeluvian biplane. But since it also saved my life, I'll let the money pass.

Here's how it came off:



I'm a barnstormer and when I thunder over the county fairs doing (in a following wind) as much as 60 m.p.h., crowds flock in for miles around to ride at $1.25 per head (75¢ to hang on the wing).

One day I try your Gulf Aviation Gas and what happens? I give her half throttle, she scorches down the pasture at 162.4 m.p.h. and the top wing fabric starts peeling off. As the bottom wing is only eight or nine years old, I am not much worried. I always did want a fast low wing job. So when the whole business blows away, I merely say to myself, "Now for the speed test."

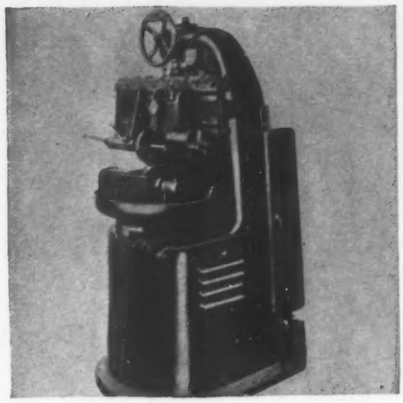
WOW! When I shoved the throttle forward, she accelerates like a rocket ship. Then the air resistance tears off the remaining wing, motor, and everything else.

Naturally, I'm quick-witted, so in that fraction of a second I remember your ad saying "Gulf Aviation Gas will never let you down."—So I grab the gas tank and perch up there till two days later when some guys come along in an autogyro.

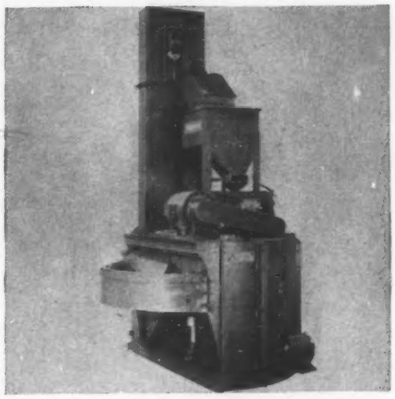
From now on you better warn us fellas who are just starting to use Gulf. So you won't forget, I'm enclosing a bill for the T.N.T. we used to blast that tank outa' the way of airliners. **W. T. Hodge**

Gulf Oil Corporation and Gulf Refining Company . . . makers of

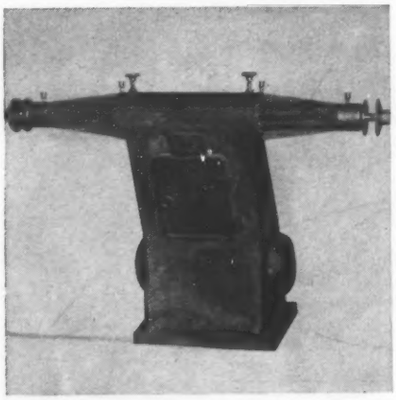
GULF **GULF AVIATION PRODUCTS**



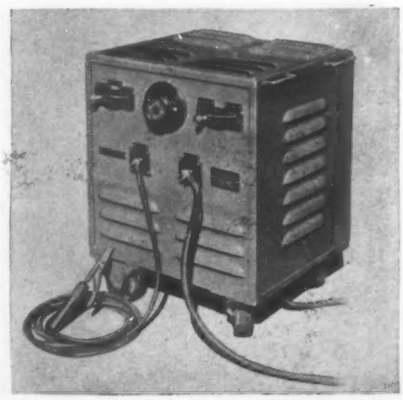
Gear Lapper—National Broach & Machine Company



Roto Blast Table—Pangborn Corporation



Double Polisher — The Standard Electric Tool Company



Electric Welding Machine—Allis-Chalmers Machine Company

Springfield Machine Tool Company
Springfield, Ohio
Personnel: Edward Montanus, Pres.
Products: Lathes

Standard Electrical Tool Co.
1938 W. Eighth St., Cincinnati, Ohio
Personnel: H. V. Feltes, Pres., L. A. Hauck, V. Pres., R. A. Huhn, Sec.
Products: Drills, Grinders, Buffers, Polishers

Standard Tool & Mfg. Co.
Arlington, N. J.
Products: Reamers

Stanley Electric Tool Div. (See Group I)

Star Machine & Engineering Corp.
Grove St. & Bloomfield, Bloomfield, N. J.
Personnel: R. Hollander, Pres.
Products: Precision Drill Grinder

Stark Tool Company
Waltham, Mass.
Products: Lathes

Sundstrand Machine Tool Co.
Rockford, Ill.
Products: Lathes, Grinders, Balancing Tools, Propeller Chucking Equipment

Taylor & Fenn Company (See Group I)

Thompson Grinder Co.
Springfield, Ohio
Products: Grinding Machines

Thurston Mfg. Co.
Providence, R. I.
Personnel: Howard G. Arnold, Sales Mgr.
Products: Milling Cutters, Die Milling Machines

Toledo General Mfg. Co.
3620 Summit Ave., Toledo, Ohio
Products: Drilling Machines

The Tomkins-Johnson Co.
Jackson, Mich.
Products: Riveting Machines, Chucks, Die Sinking, Milling, Cutters, Pneumatic Hammers

The Torrington Company
Torrington, Conn.
Products: Swaging Machines

U. S. Standard Mfg. Co.
Columbiana, Ohio
Products: Hand Milling Machines

U. S. Tool Company, Inc.
Ampere, N. J.
Products: Die Sets, Multi-Milling Machines

Universal Boring Machine Co.
Hudson, Mass.
Personnel: Charles A. Clarke, Pres.
Products: Boring Machines

Van Norman Machine Tool Co.
Springfield, Mass.
Products: Boring Bars, Grinders, Milling Machines & Lathes

Wadell Engineering Co.
Newark, N. J.
Products: Boring Fixtures

Walker-Turner Company, Inc.
Plainfield, N. J.
Products: Lathes, Saws, Drill Presses, Shapers, Special Equipment

J. D. Wallace & Company
134 S. California Ave., Chicago, Ill.
Products: Saws, Jointers, Shapers, Radial Drills, Oil, Stone Grinders, Glue Pots

Warner & Swasey Company
Cleveland, Ohio
Personnel: P. E. Bliss, Pres., Chas. J. Stilwell and Clifford S. Stilwell, V. Presidents
Products: Lathes, Screw Machines, Complete Tool Equipment

Wetmore Reamer Co.
418 N. 27th St., Milwaukee, Wis.
Personnel: Chas. G. Forster, Pres., Edw. D. Johnson, Treas.
Products: Reamers, Special Tools

Baxter D. Whitney & Son, Inc. (See Group I)

Wickes Brothers (See Group I)

Winter Brothers Company
Wrentham, Mass.
Products: Threading Tools, Taps, Dies

Yates-American Machine Co. (See Group I)

GROUP III—FINISHING—after the material has been through all the necessary forming and machining operations it has to be finished before being ready for assembly. Finishing takes various forms such as polishing and lapping or perhaps just painting. However, these final touches are often as important as the steps preceding and add another phase to production. In this group are listed manufacturers of Honing, Lapping, Polishing, Painting Machines and similar types of equipment.

Abrasive Machine Tool Co.
Dexter Rd., E. Providence, R. I.
Products: Grinders

Arter Grinding Machine Co.
Worcester, Mass.
Personnel: A. O'Donnell, Sales Mgr.
Products: Grinding Machines

Barnes Drill Company (See Group II)

Beach Manufacturing Co. (See Group I)

Bonney Forge & Tool Works
Allentown, Pa.
Personnel: A. J. Male, Mgr. Aviation Sales
Products: Drop Forgings, Tools & Welding Equip.

Builders Iron Foundry (See Group II)

Champion Pneumatic Machine Co.
8164 S. Chicago Ave., Chicago, Ill.
Personnel: G. T. Rayfield, Pres., Gen. Mgr. & Pur. Agent, Samuel Schlosser, V. Pres.
Products: Air Compressors, Paint Sprays

Champion Pneumatic Machine Co.
6 E. 44th St., New York, N. Y.
Personnel: H. A. Jackson, Pres.
Products: Air & Gas Compressors, Electric Tools

Cincinnati Electrical Tool Co. (See Group II)

Cincinnati Milling Machine & Cincinnati Grinders, Inc. (See Group II)

Cleveland Pneumatic Tool Co. (See Group II)

Detroit Electric Furnace Division
(Kuhlman Electric Co.)
825 W. Elizabeth St., Detroit, Mich.
Personnel: Albert E. Rheades, V. Pres., E. P. Lovejoy, Gen. Mgr.
Products: Electric Furnaces & Equipment, Hoists

The DeVilbiss Company
Toledo, O.
Personnel: A. D. Gutchess, Pres., F. A. Bailey, V. Pres. & Gen. Mgr., W. F. Gradolph, V. Pres.
Products: Paint Sprayers and Equipment

Eclipse Air Brush Co., Inc.
390 Park Ave., Newark, N. J.
Personnel: H. W. Beach, Pres., A. H. Cowns, Sec.
Products: Spray Equipment

The Electric Furnace Company
Salem, Ohio
Personnel: R. F. Bensinger, Pres.
Products: Furnaces (all types)

Excelsior Tool & Machine Company (See Group I)

The Fellows Gear Shaper Company (See Group II)

Foundry Equipment Company
1833 Columbus Rd., Cleveland, Ohio
Products: Core, Fuel, Oil Ovens

Gardner Machine Company (See Group II)

The Gehnrich Corporation
Long Island City, N. Y.
Products: Furnaces & Ovens

Gleason Works
Rochester, N. Y.
Products: Bevel Gear Machinery

Hall & Brown Machine Company (See Group I)

Hall Manufacturing Company (See Group II)

C. I. Hayes, Incorporated
Providence, R. I.
Personnel: J. E. Hines, Sales Mgr.
Products: Electric Furnaces

Hevi Duty Electric Company
Milwaukee, Wisc.
Personnel: E. L. Smalley, Pres., H. E. Koch, V. Pres. & Gen. Mgr.
Products: Electric Heat Treating Furnaces

The Hisey-Wolf Machine Company (See Group II)

Hobart Brothers Company
Troy, Ohio
Personnel: E. A. Hobart, Pres. & Chief Eng., W. H. Hobart, V. Pres.
Products: Welders, Test Benches, Paint Spraying Equipment

Hoskins Manufacturing Company
4435 Lawton Avenue, Detroit, Mich.
Products: Electric Furnaces, Pyrometers

James H. Knapp Co., Inc. (See Group I)

Leeds & Northrup Company
4901 Stenton Ave., Philadelphia, Pa.
Products: Electric Heat Treating Furnaces, Electrical Gages and Equipment

Lindberg Engineering Co.
221 N. Laflin St., Chicago, Ill.
Products: Furnaces (all types)

Micromatic Hone Corp.
DuBois St. at Horton Ave., Detroit, Mich.
Products: Honing Tools

Micro-Westco, Inc.
Bettendorf, Ia.
Personnel: E. J. Bettendorf, Pres.
Products: Cylinder Grinders, Pumps

Milburn Co., The Alexander (See Group I)

Moline Tool Company (See Group II)

National Broach & Machine Co. (See Group II)

New England Blower Company
Hartford, Conn.
Products: Spray Booths

Norton Company (See Group II)

Oliver Machinery Company (See Group II)

Paasche Airbrush Company
1909 Diversey Parkway, Chicago, Ill.
Personnel: J. A. Paasche, Pres., H. F. Beck, V. Pres.
Products: Air Painting Units and Accessories

Porter-Cable Machine Co.
708 N. Salina St., Syracuse, N. Y.
Products: Sanders

E. H. Sargent & Co.
Chicago, Ill.
Products: Drying Ovens

Saylor-Beall Mfg. Company
Detroit, Mich.
Products: Spray Guns

H. B. Smith Machine Company (See Group II)

Spray Engineering Company
114 Central, Somerville, Mass.
Personnel: W. B. Thompson, Pres., F. C. Dennison, V. Pres., A. S. True, Gen. Sls. Mgr.
Products: Paint Spraying Equipment

Standard Electrical Tool Co. (See Group II)

Sterling Products Co.
2457 Woodward Ave., Detroit, Mich.
Personnel: Dr. S. J. Herman, Pres., Norman B. Herman, V. Pres.
Products: Sanders, Filter Trap, Automatic Lubricator

Strong, Carlisle & Hammond (See Group I)

Surface Combustion Corp.
Toledo, Ohio
Products: Heat Treating Furnaces

Taylor Instrument Companies
Rochester, N. Y.
Personnel: H. J. Winn, Pres., W. H. Kimmel, Sec.
Products: Anodic Tanks, Regulating Equipment

Harold E. Trent Company
618 N. 54 St., Philadelphia, Pa.
Personnel: Harold E. Trent, Pres.
Products: Enamel Baking Furnaces

The Udylite Company
Detroit, Mich.
Personnel: A. B. Baldwin, Pres., L. K. Lindahl, V. Pres. & Gen. Mgr.

Yates-American Machine Co. (See Group I)

Young Bros. Company
Detroit, Mich.
Personnel: R. B. Reed, Sales Mgr.
Products: Ovens

GROUP IV—FASTENING AND ASSEMBLY

—the production line is concluded with the assembly of the various already formed units into the completed product. To assemble these units various machines are required to fasten the material together through use of rivets, stitching processes, welding or often with nuts and bolts. The manufacturers making the Riveting Machines, Stitching Machines, Welding Machines, of both the gas flame and electric arc types, and other similar equipment, have been listed here in Group IV.

Air Reduction Sales Company
60 E. 42nd St., New York, N. Y.
Personnel: C. S. Munson, Pres., A. R. Ludlow, V. Pres., R. B. Davidson, Sec.
Products: Welding Apparatus, Equipment & Supplies

Athol Mfg. Co.
Athol, Mass.
Products: Lacquered Fabrics

The Bastian Blessing Co.
240 E. Ontario St., Chicago, Ill.
Personnel: L. G. Blessing, Pres., E. L. Mills, V. Pres. & Sales, Eng.
Products: Welding Equip. & Supplies

Bellevue Industrial Furnace Co. (See Group I)

Binks Manufacturing Co.
3124 W. Carroll Ave., Chicago, Ill.
Personnel: J. F. Roche, Pres., S. Bramsen, V. Pres. & Chief Engr.
Products: Spray Finishing Equip.

Chicago Rivet & Machine Co.
Chicago, Ill.
Personnel: J. A. Moore, Pres.
Products: Riveting Machines

Cleveland Pneumatic Tool Co. (See Group II)

Commonwealth Mfg. Corporation
4208 Davis Lane, Cincinnati, Ohio
Personnel: R. R. Bollman, Pres.
Products: Welding Machines & Equipment

E. Corey & Company
65 W. Commercial, Portland, Me.
Products: Straightening Machines

Dynamic Welder Company
2225 Silverton Rd., Chicago, Ill.
Products: Welders

Engineering & Research Corp. (See Group I)

Federal Machine & Welder Co.
Dana Avenue, Warren, Ohio
Personnel: F. P. McBerty, Pres., Z. A. McBerty, Sec.-Treas.
Products: Electric Welders

Chas. E. Francis Company (See Group I)

Hannifin Manufacturing Company (See Group I)

Harnischfeger Corporation
Milwaukee, Wisc.
Personnel: W. Harnischfeger, Pres., F. Salditt, V. Pres.
Products: Cranes, Arc Welders & Equipment

Heston & Anderson (See Group I)

High Speed Hammer Co., Inc. (See Group II)

Hobart Brothers Company (See Group III)

Ideal Electric & Mfg. Company
E. 1 & Oak, Mansfield, Ohio
Personnel: S. G. Vinson, Pres. & Gen. Mgr., O. H. McDaniel, Sec.
Products: Welders

Ingersoll-Rand Company (See Group II)

Lake Erie Engineering Corp. (See Group I)

The Lincoln Electric Co.
12818 Coit Rd., Cleveland, Ohio
Personnel: J. F. Lincoln, Pres., A. F. Davis, and C. M. Taylor, V. Pres., J. W. Meriam, Sec.
Products: Welders & Welding Equipment

Linde Air Products Co.
(Unit Union Carbon & Carbide Co.)
30 East 40th St., New York, N. Y.
Products: Welding Apparatus & Equipment

Metal & Thermit Corporation
120 Broadway, New York, N. Y.
Personnel: J. B. Tinnon, Sales Mgr.
Products: Welding Equipment

Milburn Co., The Alexander (See Group I)

Peerless Machine Company (See Group II)

Penn Rivet Corp.
Philadelphia, Pa.
Personnel: T. M. Searles, Pres.
Products: Rivets & Riveting Machines

Progressive Welder Company (See Group I)

Singer Sewing Machine Co.
Singer Building, New York, N. Y.
Products: Sewing Machines

Smith Welding Equipment Corp. (See Group I)

E. B. Stimson & Co.
70 Franklin Ave., Brooklyn, N. Y.
Products: Riveters

Thomson-Gibb Electric Welding Co.
Lynn, Mass.
Products: Welders & Equipment

The Tomkins-Johnson Co. (See Group II)

Torchweld Equipment Co. (See Group I)

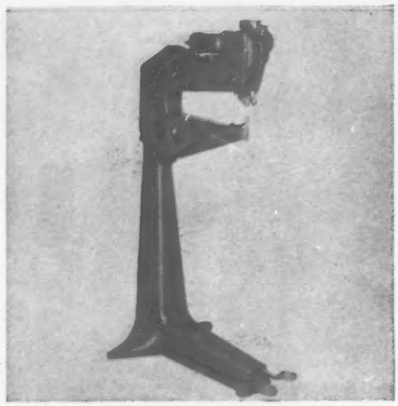
Union Special Machine Co.
400 N. Franklin St., Chicago, Ill.
Personnel: A. M. Sheldon, Pres., Richard MacKay, Jr., V. Pres.
Products: Sewing Machines

J. D. Wallace & Company (See Group II)

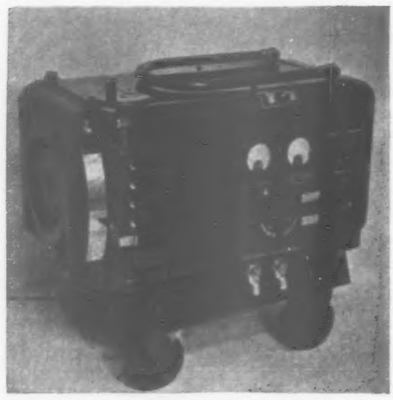
Weldit Corporation
Detroit, Mich.
Products: Welding Torches

Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pa.
Products: Electrical Equipment, Welding Apparatus

Wilson Welder & Metals Co., Inc.
60 E. 42d St., New York, N. Y.
Products: Welding Machines and Equipment



Automatic Punching and Riveting Machine —Engineering & Research Corporation



Electric Arc Welder—Harnischfeger Corporation

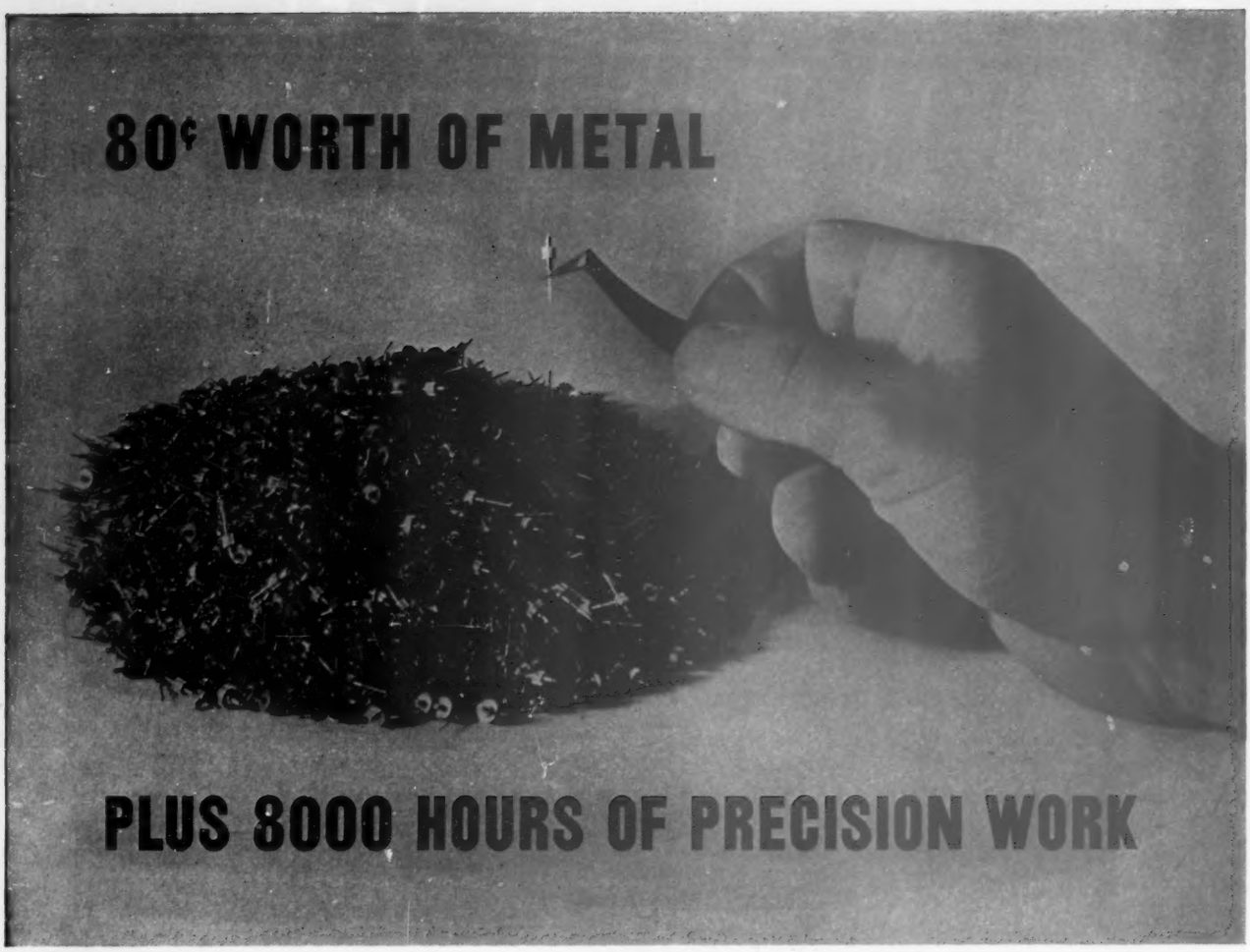
Pneumatic Riveting Hammer—The Independent Pneumatic Tool Company

Automatic Riveter—The Tompkins-Johnson Company

PRESTIGE

NORTH AMERICAN AVIATION, INC.

INGLEWOOD, CALIFORNIA, U.S.A.

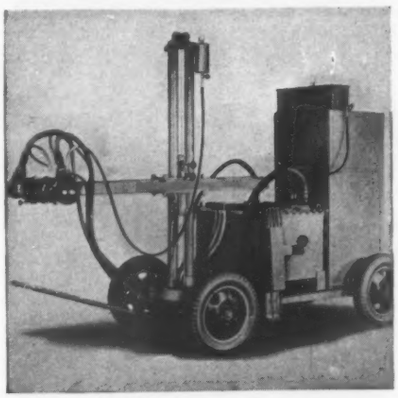


Precision parts for KOLLSMAN SENSITIVE ALTIMETERS—8000 hours of precision work applied to 80 cents worth of metal

KOLLSMAN FOR PRECISION is not just a phrase. It is a dynamic, demonstrable fact that sums up both the ideal and the achievement of Kollsman Instruments. It is a challenge and incentive that permits no let-down in any Kollsman operation. In the manufacture of Kollsman Instruments, "precision" frequently means working to limits of .0001"—one ten-thousandth of an inch. In performance, Kollsman Precision Instruments function to unsurpassed standards of accuracy. That is why "Kollsman for Precision" is a truth recognized in aviation the world over. That is why you can always rely on Kollsman Precision Instruments.

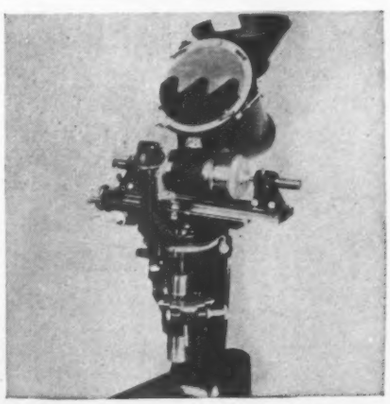
KOLLSMAN INSTRUMENT COMPANY, INC.
8008 FORTY-FIFTH AVENUE ELMHURST, NEW YORK
WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIFORNIA

Manual Jack—Coffing Hoist Company



Portable X-Ray Machine—General Electric X-Ray Corporation

75-Ton Straightening Press—Hanifin Manufacturing Company



Comparator—Jones & Lamson Machine Company

GROUP V—MISCELLANEOUS PRODUCTION EQUIPMENT—in addition to the machines listed in the four preceding groups, there are numerous other machines and equipment which perform operations that aid in the production line. Blueprinting or copying machines which speed up production and make it easier, are examples, as are die casting, drills, rivets, hoists, etc. In this group manufacturers of these machines are listed, many of which are also manufacturers of machine tools listed in one of the preceding groups.

Acme Diamond Tool Co.
15 Maiden Lane, New York, N. Y.
Personnel: A. P. Stecker, Gen. Sales Mgr.
Products: Diamond Pointed Tools, Wheels, Dressers

Ahlberg Bearing Co.
Chicago, Ill.
Personnel: T. H. Staerk; Fred O. Burkholder, V. Pres. & Sales Mgr.

Air Associates, Inc. (See Group I)

Allen Mfg. Co.
133 Sheldon St., Hartford, Conn.
Personnel: H. R. Grant, Pres.
Products: Set Screws, Pipe Plugs, Tap Extensions

Allis-Chalmers Manufacturing Co.
1126 S. 70th St., Milwaukee, Wisc.
Personnel: Geo. J. Callos, Adv. Mgr.
Products: Electrical Equipment

American Chain & Cable Co., Inc.
(American Cable Division)
York, Pa.
Personnel: W. B. Lasher, Pres., Geo. C. Moon, V. Pres., W. M. Wheeler, Sec.
Products: Wire, Rope & Cable

Apex Machine & Tool Co.
Dayton, Ohio
Personnel: Carl A. Lange, Pres.
Products: Chucks, Collets, Reamers, Wrenches, etc.

Armstrong Bros. Tool Co. (See Group II)

Atlas Drop Forge Co.
Lansing, Mich.
Personnel: Mr. Goodnow, Gen. Mgr.
Products: Drop Forgings

Baker-Raulang Company
(Baker Industrial Truck Div.)
Cleveland, Ohio
Personnel: E. J. Bartlett, Pres., H. H. Remde, Gen. Mgr.
Products: Trucks & Hydraulic Lifts

Baker Brothers, Inc. (See Group II)

Baldwin-Southwark Corp. (See Group I)

Barber-Colman Co. (See Group II)

W. F. and John Barnes Company (See Group II)

Barrett-Cravens Co.
3262 W. 30th St., Chicago, Ill.
Personnel: A. M. Barrett, Pres., E. J. Heimer, V. Pres., Adv. & Gen. Sales Mgr.
Products: Trucks, Elevators & Storage Racks

The Leon J. Barrett Co.
Worcester, Mass.
Personnel: L. J. Barrett, Pres., C. T. Appleton, V. Pres.
Products: Dryers, Separators, Impregnators

John Bath & Company, Inc.
Worcester, Mass.
Personnel: S. W. Bath, Pres., J. Chester Bath, V. Pres.
Products: Taps, Precision Inst., Dies, Gages

Bausch & Lomb Optical Co.
632 St. Paul St., Rochester, N. Y.
Personnel: Rudolph Miller, Adv. Mgr.
Products: Optical Equip. & Measuring Devices

Bay State Tap & Die Co. (See Group II)

Beebe Brothers (see Group I)

Bicknell-Thomas Company (See Group I)

Billings & Spencer Co. (See Group I)

Birdsboro Steel Foundry and Machine Co.
(See Group I)

Blackhawk Manufacturing Co.
Milwaukee, Wisc.
Personnel: H. P. Brumder, Pres., John Merker, V. Pres. & Gen. Mgr.
Products: Wrenches & Hydraulic Sacks

Blackman & Neutzel Mach. Co.
St. Louis, Mo.
Products: Mach. Tools

The Blanchard Machine Company (See Group II)

Bonney Forge & Tool Works (See Group III)

Bower Roller Bearing Company
3040 Hart St., Detroit, Mich.
Personnel: Walter Bennett, V. Pres. & Sales Mgr.

Bradford Machine Tool Co.
657 Evans, Cincinnati, Ohio
Products: Drills

Bristol Company
Waterbury, Conn.
Products: Heat Measuring Devices

Breese Corporations, Inc.
24-26 S. Sixth St., Newark, N. J.
Personnel: J. J. Mascuch, Pres., John W. Young, V. Pres., J. F. Lucas, V. Pres. & Sales Mgr.
Products: Metal Hose, Flexible Shafts

Brown & Sharpe Mfg. Company (See Group II)

Brunner Manufacturing Company
1821 Broad St., Utica, N. Y.
Personnel: G. L. Brunner, Pres., G. L. Brunner, Jr., Sec.
Products: Air Compressors

Charles Bruning Co., Inc.
445 Plymouth Court, Chicago, Ill.
Products: Blue Printing Equip.

Buffalo Forge Co. (See Group I)

Buffalo Scale Co., Inc.
Buffalo, N. Y.
Personnel: T. L. Richmond, Jr., Pres., E. D. Gordon, V. Pres., L. A. Schuh, Treas.
Products: Scales, Balances & Testing Equip.

Builders Iron Foundry (See Group II)

Burton-Rogers Company
857 Boylston St., Boston, Mass.
Personnel: C. W. Burton, Pres.
Products: Shop Equip.

Canton Foundry & Machine Co.
6400 Breakwater Ave., Cleveland, Ohio
Products: Cranes, Turntables

Carborundum Company
Niagara Falls, N. Y.
Products: Grinding Wheels, Abrasives

Canedy-Otto Mfg. Co. (See Group I)

Carboloy Co., Inc.
P. O. Box 239, R. Pk. A., Detroit, Mich.
Personnel: W. G. Robbins, Pres.
Products: Cemented Carbide Tools, Dies & Wheel Dressers

S. W. Card Manufacturing Company
(Div. Union Twist Drill Co.)
Mansfield, Mass.
Products: Taps, Dies, Screw Plates

Cedar Rapids Eng. Co. of Del. (See Group II)

Champion Blower & Forge Company
(See Group I)

John Chatillon & Sons
85-89 Cliff St. New York, N. Y.
Personnel: George E. Chatillon, Pres., A. J. Chatillon, Sec.
Products: Scales, Springs

Chicago Flexible Shaft Company
Chicago, Ill.
Products: Flexible Shafts

Chicago Pneumatic Tool Co. (See Group III)

The Cimatool Company
June & E. 33rd St., Dayton, Ohio
Personnel: Lewis Poock, Gen. Mgr.
Products: Tools

Cleveland Universal Jig Co. (See Group II)

Coffing Hoist Company
Danville, Ill.
Products: Hoists and Jacks

Arthur Colton Company
Detroit, Mich.
Products: Tools, High Speed Twist Drills

Columbian Vise & Mfg. Company
9021 Bessemer Ave., Cleveland, Ohio
Personnel: Dan C. Swander, Pres. & Gen. Mgr., H. F. Seymour, V. Pres.
Products: Vices & Clamps

Continental Tool Works
(Div. Ex-Cell-O Corp.)
1200 Oakman Blvd., Detroit, Mich.
Products: Counterbores, Core Drills, Reamers, Face Milling Cutters

Covel-Hanchett Company
Big Rapids, Mich.
Products: Knife Grinders, Saw Sharpeners, Filers & Setters

Curtis Pneumatic Machinery Co.
(Div. of Curtis Mfg. Co.)
St. Louis, Mo.
Personnel: Walter C. Hecker, Pres., Frank Ackerman, V. Pres.
Products: Servicing Equipment, Air Compressers, Air Hoists, etc.

The Cushman Chuck Company
Hartford, Conn.
Personnel: E. V. N. Myers, N. Y. Mgr.
Products: Drilling Machine Chucks

Dalrae Tools Company
Syracuse, N. Y.
Products: Milling Attachments

Davis Keyseater Company
399 Exchange St., Rochester, N. Y.
Personnel: E. A. Grenelle, Mgr.
Products: Keyseaters and Cutters

J. H. Day Company
Cincinnati, Ohio
Products: Glue Mixers

Detroit Electric Furnace Division
(See Group III)

Detroit Tap & Tool Company
Detroit, Mich.
Products: Taps

De Walt Products Corporation
Fountain Ave., Lancaster, Pa.
Personnel: Paul Gardner, Pres., W. Ross Stevens, Gen. Mgr.
Products: Machine Tools (Metals & Woodworking)

Dumore Company (See Group II)

Eastern Machine Screw Corp. (See Group II)

Eastman Machine Company
Buffalo, N. Y.
Personnel: Wade Stevenson, Pres.
Products: Cloth Cutting Machines

Eclipse Aviation
(Div. of Bendix Aviation Corp.)
Bendix, N. J.
Personnel: Charles Marcus, Pres., R. P. Lansing, V. Pres., H. A. Gossner, Sec.
Products: Tools for Aircraft Stations and Generators, Test Stands

Electric Specialty Company
Stamford, Conn.
Products: Electrical Motors, Equipment

Enterprise Tool & Gear Co.
8320 E. McNichols, Detroit, Mich.
Products: Miscelianeous Tools

Etna Machine Company (See Group II)

Errington Mech. Laboratory
Staten Island, N. Y.
Products: Chucks, Tapping Heads

Ex-Cell-O Corporation (See Group I)

The Fairbanks Company
393 Lafayette St., New York, N. Y.
Personnel: Geo. N. Naylor, Pres.
Products: Industrial Trucks

Fairbanks, Morse & Company
600 S. Michigan Ave., Chicago, Ill.
Personnel: Col. R. H. Morse, Pres. & Gen Mgr., S. T. Kiddoo, V. Pres. & Treas., A. C. Dodge, V. Pres. & Gen. Sales Mgr.
Products: Scales

Federal Products Corp.
1144 Eddy St., Providence, R. I.
Products: Dial Gages & Measuring Instruments

The Fellows Gear Shaper Company
(See Group II)

The R. Y. Ferner Company (See Group II)

Firth Sterling Company
710 W. Lake Street
Products: Tungsten Carbide Tools

Fiske Brothers Refining Company
129 Lockwood St., Newark, N. J.
Personnel: F. J. Snyder, Pres., C. Rodriguez, V. Pres., F. W. Edwards, Sec.-Treas.
Products: Lubricators

Foster Machine Company (See Group II)

Fostoria Pressed Steel Corp.
Fostoria, Ohio
Personnel: R. J. Carter, Pres. & Treas., C. W. McDaniel, V. Pres. & Sec.
Products: Coolant Filters & Machine Lamps

Chas. E. Francis Company (See Group I)

The Fairing Tool Company (See Group II)

Garrison Machine Works, Inc. (See Group II)

General Electric Company
Schenectady, N. Y.
Products: Electrical Equipment

General Electric Vapor Lamp Co.
Hoboken, N. J.
Products: Lighting Equipment

General Electric X-Ray Corporation
2012 Jackson Blvd., Chicago, Ill.
Products: X-Ray Equipment

General Machinery Corporation (See Group I)

The Geometric Tool Co. (See Group II)

Gisholt Machine Company (See Group II)

Giddings & Lewis Mach. Company
142 Doty, Fond du Lac, Wisconsin
Personnel: H. B. Krant, Pres. & Gen. Mgr., Russel E. Hanson, V. Pres., F. W. Chadbourne, Sec.
Products: Tools

Gleason Works (See Group III)

Goddard & Goddard Co., Inc.
12280 Burt Rd., Detroit, Mich.
Personnel: A. N. Goddard, Pres. & Gen. Mgr., H. Hagerty, Sec.
Products: Cutting Tools

Gorham Tool Company
Detroit, Mich.
Products: High Speed Tools

George Gorton Machine Company
(See Group II)

Grand Rapids Machine Company
Grand Rapids, Mich.
Products: Drill Grinders

Greenfield Tap & Die Corporation
Greenfield, Mass.
Personnel: D. M. Millar, Pres.
Products: Taps, Dies, Drills, Reamers, etc.

Grob Brothers (See Group II)

Hack Machine Company
Chicago, Ill.
Personnel: F. W. Hack, Pres.
Products: Die Making Machines

Handy & Harman
82 Fulton St., New York, N. Y.
Products: Fluxes

Hannifin Manufacturing Co.
(See Groups I & IV)

Hanson-Whitney Machine Co. (See Group II)

Harnischfeger Corporation (See Group IV)

Hartford Special Machinery Co.
Hartford, Conn.
Personnel: R. J. Dunn, Adv. Mgr.
Products: Spacing Indexing Fixture

R. G. Haskins Company (See Group II)

Haynes Stellite Company
(Unit-Union Carbide & Carbon Corp.)
Kokomo, Ind.
Products: Metal Cutting Tools, Burnishers, Welding Rods

Hendey Machine Company (See Group II)

Hjorth Lathe & Tool Company (See Group II)

Hobart Brothers Company (See Groups III & IV)

Hoefer Manufacturing Co.
20 Liberty St., Freeport, Ill.
Products: Multiple Drill Heads

Homestead Valve Mfg. Co., Inc.
Coraopolis, Pa.
Products: HI Pressure Jenny Cleaner

Hoskins Manufacturing Company
(See Group III)

Hydraulic Press Mfg. Company (See Group I)

Illinois Tool Works
2501 N. Keeler Ave., Chicago, Ill.
Personnel: Mr. England, V. Pres.
Products: Profile Measuring Machine, Gear Measuring Machines

Independent Pneumatic Tool Co. (See Group II)

Ingersoll-Rand Co. (See Groups II & IV)

International Tool Works
Indianapolis, Ind.
Personnel: O. B. Iles, Pres.
Products: Tools

Jacobs Manufacturing Company
Hartford, Conn.
Products: Chucks

Charles L. Jarvis Company (See Group II)

Jones & Lamson Machine Co. (See Group II)

Kearney & Trecker Corporation (See Group II)

Kingsbury Machine Tool Corp. (See Group II)

Lamson & Sessions Company
Cleveland, Ohio
Products: Screw Products

Leeds & Northrup Company (See Group III)

The Lees-Bradner Company (See Group II)

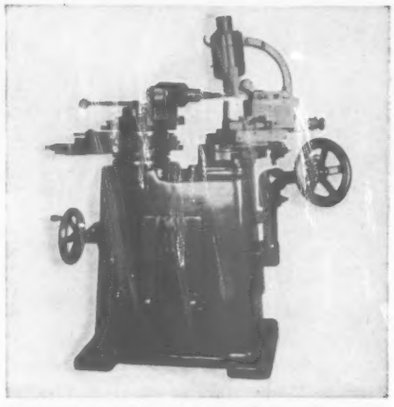
Lewis-Shepard Sales Corp.
Watertown, Mass.
Personnel: A. L. Lewis, Pres.
Products: Trucks, Portable Elevators, Cranes, etc.

Lincoln Machine Company
263 Esten Ave., Pawtucket, R. I.
Products: Tools

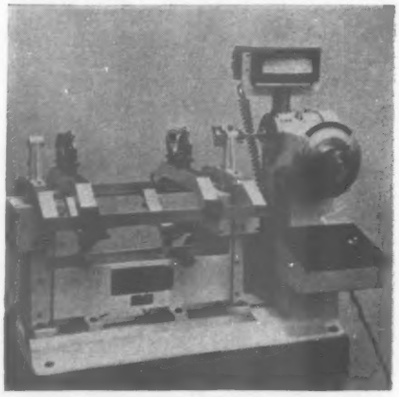
Logansport Machine, Inc. (See Group I)

Lowell Wrench Company
Worcester, Mass.
Products: Tools

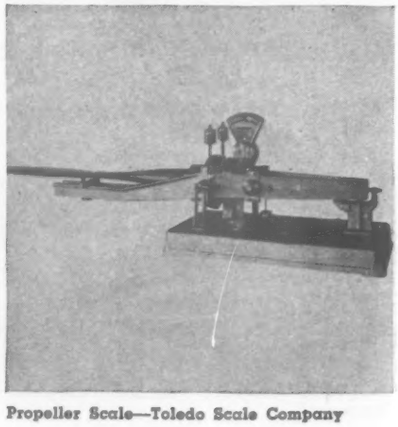
Gear Tooth Gage—National Broach & Machine Company



Miller Tool Grinder—Oliver Machinery Company



Supercharger Impeller Balancer — Tinius Olsen Testing Machine Company



Propeller Scale—Toledo Scale Company

Air View of Parks Air College, East St. Louis, Ill.

The Recognition Accorded Your School Directly Affects Your Future

Let PARKS Accredited Training Prepare You For Success!

The new Aeronautical Engineering Building at Parks Air College

Parks Hall, also showing a portion of the campus gardens

FAVORABLE RECOGNITION, by authorities and public alike, is one standard by which you can measure the standing of any educational institution—it is a useful yardstick by which to judge its value to you, who are considering a career based upon specialized training in the field of aviation.

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● Recognition and approval is given to the Parks Aeronautical Engineering School by the Superintendent of Public Instruction of the State of Illinois.

● Parks Air College is registered with the Department of Registration and Education of the State of Illinois.

● Parks Air College is listed in the Institutions of Higher Education, published by the Office of Education, Department of the Interior.

● Parks Air College is accredited by the Army Air Corps, and graduates holding the Bachelor of Science Degree fulfill educational Requirements for appointment to the Air Corps as Flying Cadets.

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Parks Air College
East St. Louis, Illinois. Section AV-12

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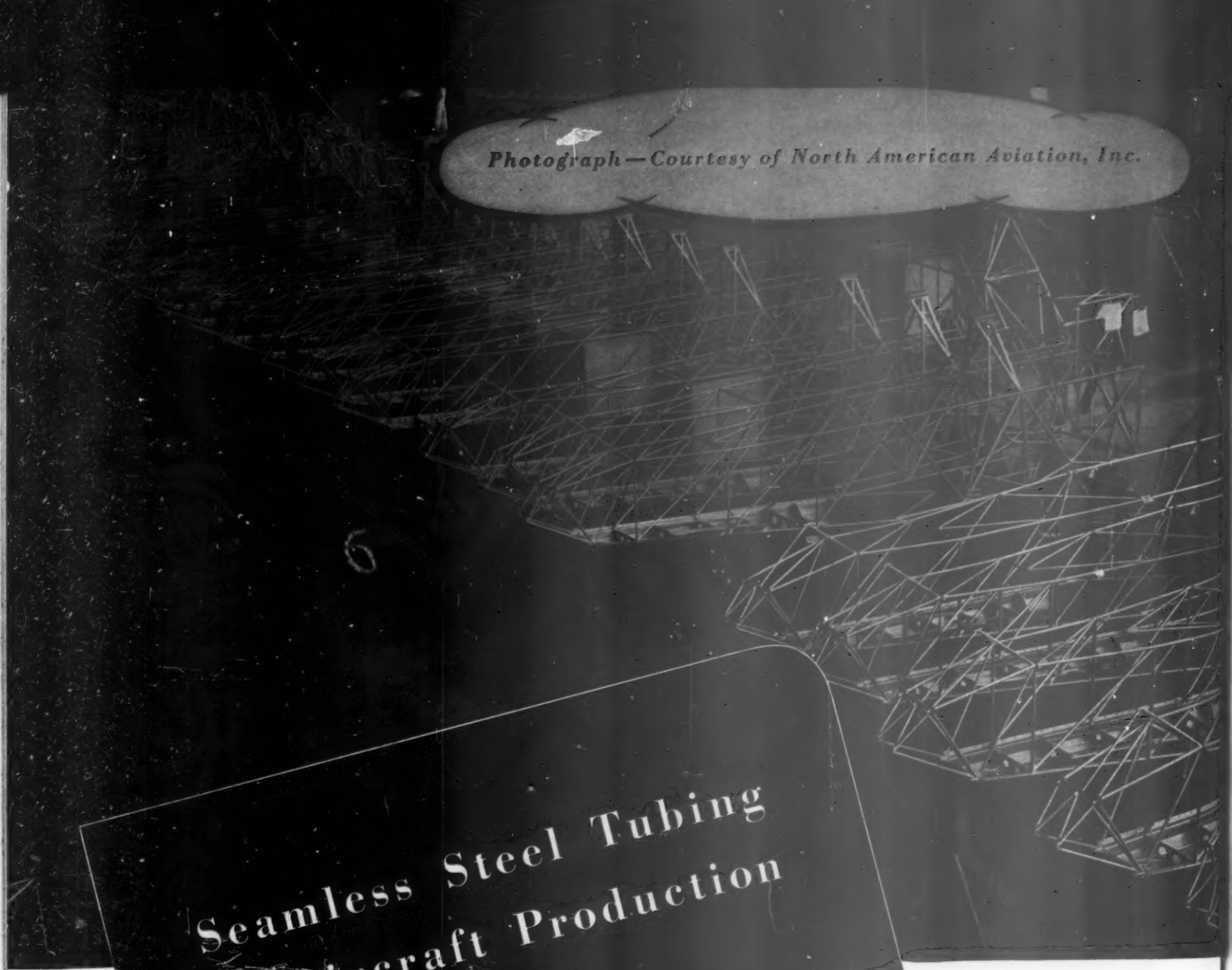


Seamless Steel Tubing in Aircraft Production

WIDE USE OF TUBING

This photograph is typical of fabricating activity in many plants from coast to coast. Ships for training, observation, liaison, photography, dive bombing — all of steel tubing construction.

SUMMERILL'S PART

Work that Summerill has done to produce cleaner steel, better finish, higher physicals and control of grain size for improved welding is contributing to this wider use of tubing.

NEW EQUIPMENT

Readily available as seamless steel tubing now is for high production of aircraft structures, Summerill prepares for still greater availability. New, additional production equipment is in operation this month.

SUMMERILL MEN

Summerill's position today as a supplier of aircraft materials is largely due to experienced men who are proud of the important part they are playing in the growth of the aircraft industry.

SUMMERILL TUBING COMPANY

BRIDGEPORT, MONTGOMERY CO., PENNSYLVANIA

Lufkin Rule Co.
Hess St., Saginaw, Mich.
Personnel: M. A. Ellis, Sales Dept.
Products: Measuring Equipment

Magnaflux Corporation
25 West 43rd St., New York, N. Y.
Personnel: A. V. deForest, Pres., F. B. Doane, V. Pres. & Treas., C. A. McCune, Sec.

Martin-Rockwell Corporation
Jamestown, N. Y.
Personnel: Chas. W. Rausch

McCrosky Tool Corporation
Meadville, Pa.
Products: Tools

McGill Mfg. Co. (See Group II)

Michigan Tool Company (See Group II)

Micro-Westco, Inc. (See Group III)

Miller Co., J. W.
5917 S. Main St., Los Angeles, Calif.
Products: Electrical Radio Equipment

Moline Tool Company (See Groups II & III)

Morgan Engineering Co. (See Group I)

Morse Twist Drill & Machine Co.
163 Pleasant, New Bedford, Mass.
Personnel: W. T. Read, Pres., F. O. Lincoln, V. Pres.
Products: Drills, Taps, Dies, Cutters, Reamers, Small Tools

Mummert-Dixon Co. (See Group II)

National Acme Co.
170 E. 131st St., Cleveland, Ohio
Products: Automatic Machines & Products

National Broach & Machine Co.
(See Groups II & III)

National Machine Tool Co. (See Group II)

New Advance Machinery Co. (See Group II)

Nicholson File Company
Providence, R. I.
Personnel: W. L. Pond, Sales Mgr.
Products: Files, Rasps

W. H. Nicholson & Co.
Wilkes-Barre, Penna.
Products: Mandrels

Nielsen, Inc. (See Group II)

Niles-Bement-Pond Company (See Group II)

Northill Company, Inc. (See Group I)

Norton Company (See Groups II & III)

Oliver Machinery Company (See Groups II & III)

Tinius Olsen Testing Machine Co.
500 North 12th St., Philadelphia, Penna.
Products: Testing & Balancing Machines

Onsrud Machine Works, Inc. (See Group II)

Oster Manufacturing Co. (See Group II)

Oralid Corporation
354 Fourth Ave., New York, N. Y.
Personnel: F. W. von Nelster, Exec. V. Pres., John Cassell, V. Pres.
Products: Dry White Print Machines & Blue Printing Machines

Pangborn Corporation
Hagerstown, Md.
Personnel: T. W. Pangborn, Pres., J. C. Pangborn, V. Pres., P. J. Potter, V. Pres.
Products: Cleaning Equipment, Dust Collectors & Exhausters and Blowers

Paragon-Revolute Corporation
Rochester, N. Y.
Products: Blue Printing Machinery

Chas. Parker Company
Meriden, Conn.
Products: Vises

The C. F. Pease Company
2601 W. Irving Pk. Rd., Chicago, Ill.
Products: Blue Printing Machinery

Penn Rivet Corporation
3rd & Huntington Sts., Philadelphia, Pa.
Personnel: T. M. Searles, President
Products: Rivets & Riveting Machines

Plomb Tool Company
Los Angeles, Calif.
Products: Special Aviation Tools

H. P. Preis Engrvg. Machine Co.
159 Summit St., Newark, N. J.
Products: Engraving Machines

Procunier Safety Chuck Co. (See Group II)

Thomas Prosser & Son
120 Wall St., New York, N. Y.
Products: Carbide Cemented Tools

R & L Tools
Nicetown, Philadelphia, Pa.
Personnel: J. E. Poorman
Products: Tools, Tap & Die Welders, Tool Posts

Racine Tool & Machine Co. (See Group I)

The Ready Tool Co.
Bridgeport, Conn.
Personnel: Thomas Fish, Pres., Harold Fish, Sec. & Treas.
Products: Tools

Reed Mfg. Co.
Erie, Pa.
Products: Vises, Jigs (air-operated)

Reed-Prentice Corporation (See Group II)

Rivett Lathe & Grinder, Inc. (See Group II)

Robbins & Myers, Inc.
1345 Logonda Ave., Springfield, Ohio
Personnel: C. H. Clarke, Sales Mgr.
Products: Cranes and Hoists

Rogers Products Co., Inc.
3711 Hudson Blvd., Jersey City, N. J.
Personnel: C. L. Zabriskie, Pres. & Sec., Herman Albertine, Pres. & Chief Eng.
Products: Hydraulic Jacks, Lubricating Equipment

Rockford Die & Tool Works
1816-17th Avenue, Rockford, Ill.
Personnel: C. A. Dahlgren, Pres.
Products: Tools, Jigs, Dies, Special Machinery

Stanley P. Rockwell Co.
Hartford, Conn.
Products: Rockwell Hardness Testers

St. John X-Ray Service, Inc.
Long Island City, N. Y.
Personnel: Herbert R. Isenburger, Pres., Dr. Ancel S. John, V. Pres.
Products: X-Ray Apparatus (portable)

George Scherr Company (See Group II)

Scintilla Magneto Co., Inc.
Sidney, N. Y.
Personnel: Vincent Bendix, Pres., H. Hanni, V. Pres. & Gen. Mgr.
Products: Magneto Tools, Testing Stands, Chargers

Sebastian Lathe Company (See Group II)

Seneca Falls Machine Co. (See Group II)

Sharples Specialty Co.
Philadelphia, Pa.
Personnel: H. H. Lament, V. Pres.
Products: Centrifugal Oil Purifiers & Reclaimers

Sheffield Gage Corporation
Dayton, Ohio
Products: Vibration Meters

Sheldon Machine Co. (See Group II)

Simonds Saw & Steel Co.
Fitchburg, Mass.
Personnel: A. T. Simonds, Pres., R. A. Shaffer, Gen. Sales Mgr.
Products: Files, Saws

Skilsaw, Inc. (See Group II)

The Skinner Chuck Company
New Britain, Conn.
Personnel: A. E. Thornton, Pres.
Products: Chucks, Air Cylinders

Snap-On Tools Corporation
Kenosha, Wisc.
Personnel: E. W. Myers, Pres., J. Johnson, V. Pres. & Treas.
Products: Shop Tools

Southern Iron & Equipment Co.
Atlanta, Ga.
Products: Wash Tanks

Speedway Manufacturing Company
1834 S. 52nd Ave., Cicero, Ill.
Personnel: G. L. Newcomb, Sls. Mgr.
Products: Portable Tools, Small Motors

Square-D Company
710 S. 3rd St., Milwaukee, Wisc.
Products: Electrical Control Systems

The L. S. Starrett Company
Athol, Mass.
Personnel: F. A. Ball, Pres., D. Findlay, V. Pres. & Gen. Sales Mgr.
Products: Mechanical Precision Tools, Measuring Devices

Sterling Products Co. (See Group III)

Stevens-Walden, Inc.
Worcester, Mass.
Personnel: H. W. Bleckley, Pres. & Gen. Mgr., H. P. Adams, V. Pres. & Treas.
Products: Tools

N. A. Strand & Co.
5001 N. Wolcott Ave., Chicago, Ill.
Products: Portable Flexible Shaft Tools

The Strippit Corporation
1559 Niagara St., Buffalo, N. Y.
Personnel: J. A. Randolph
Products: Dies (all shapes)

Sundstrand Machine Tool Co. (See Group II)

Taft-Peirce Manufacturing Co.
Woonsocket, R. I.
Personnel: F. S. Blackall, Jr., Pres., J. W. Wheeler, Jr., V. Pres., W. A. Gordon, III., Sec.
Products: Tools, Propeller Checking Devices

Taylor Instrument Companies (See Group III)

Teleweld, Inc.
Chicago, Ill.
Personnel: H. E. McKee, V. Pres.
Products: Portable Binnell Instruments

George A. Terry
350 S. Elmwood Ave., Buffalo, N. Y.
Products: Drills and Attachments

Thomson-Gibb Electric Welding Co.
(See Group IV)

Titan Tool Company
Fairview, Pa.
Products: Stud Drivers & Setters, Chucks & Collets

Toledo Scale Company
Toledo, Ohio
Products: Propeller Balancing Gage, Testing Apparatus & Gages

The Tompkins-Johnson Co. (See Group II)

Triner Sales Company, Inc.
222 N. Bank Drive, Chicago, Ill.
Personnel: J. M. Triner, Pres.
Products: Scales

Union Carbide Company
30 E. 42nd St., New York, N. Y.

Union Twist Drill Co.
(Butterfield Division)
Derby Line, Vt.
Products: Taps

U. S. Air Compressor Co.
5300 Harvard Ave., Cleveland, O.
Personnel: R. L. Bacher, Pres., W. C. Smith, V. Pres. & Sec., K. S. Clapp, Gen. Mgr.
Products: Air Compressers, Grease Gun

United States Drill Head Co.
1954 W. Sixth St., Cincinnati, Ohio
Products: Drill Heads

United States Electric Tool Co.
2488 W. Sixth St., Cincinnati, Ohio
Personnel: J. A. Smith, Pres., J. C. Smith, V. Pres.
Products: Portable Electric Tools

U. S. Electrical Motors, Inc.
200 E. Stanson Ave., Los Angeles, Calif.
Personnel: H. G. Steele, Pres.
Products: Motors for Machine Tools

U. S. Tool Company, Inc. (See Group II)

The V. & O. Press Company, Inc.
(See Group I)

Van Dorn Electric Tool Co.
(Div. Black & Decker Mfg. Co.)
Towson, Md.
Personnel: R. D. Black, Sales Mgr.
Products: Portable Electric Tools

Veeder-Root Inc.
15 Sargent St., Hartford, Conn.
Personnel: Graham Anthony, Pres., G. H. Chaplin, V. Pres.
Products: Speed Measuring Instruments

Walker Mfg. Co.
Racine, Wisc.
Personnel: W. T. Walker, Pres., W. H. Walker, V. Pres.
Products: Jacks, Electric Lifts

Walker-Turner Company, Inc. (See Group II)

J. D. Wallace & Company (See Group II & IV)

Warner & Swasey Company (See Group II)

Western Tool & Mfg. Co.
Springfield, Ohio
Products: Mandrels

Westinghouse Elec. & Mfg. Co. (See Group IV)

The D. E. Whiton Machine Co.
New London, Conn.
Products: Centering Machines

Wickes Brothers (See Groups I & II)

J. H. Williams & Company (See Group I)

Wilson Mechanical Inst. Co.
377 Gerard Ave., New York, N. Y.
Products: Rockwell Hardness Testers

Worthington Pump & Machine Co.
Harrison, N. J.
Products: Compressors, Pumps, Meters, Diesel & Gas Engines

Wright Mfg. Div.
(American Chain & Cable Co.)
York, Penn.
Personnel: C. B. Veit, Sales Mgr.
Products: Hoists, Trolleys, Cranes

Wrought Washer Mfg. Co.
2100 S. Bay St., Milwaukee, Wisc.
Personnel: F. C. Doepke, Pres., E. Caldwell, Gen. Mgr., C. H. Disch, V. Pres., W. F. Disch, Sec.-Treas.
Products: Washers, Expansion Plugs, Stampings, Screw Machine Products, Tools, Dies

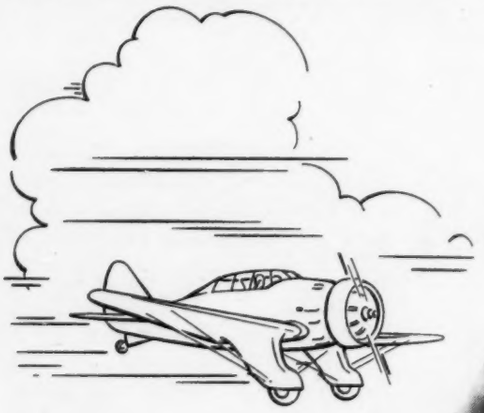
Yale & Towne Mfg. Company
(Philadelphia Div.)
4540 Tacony St., Philadelphia, Pa.
Products: Electric Chain & Cable Hoists, Trucks

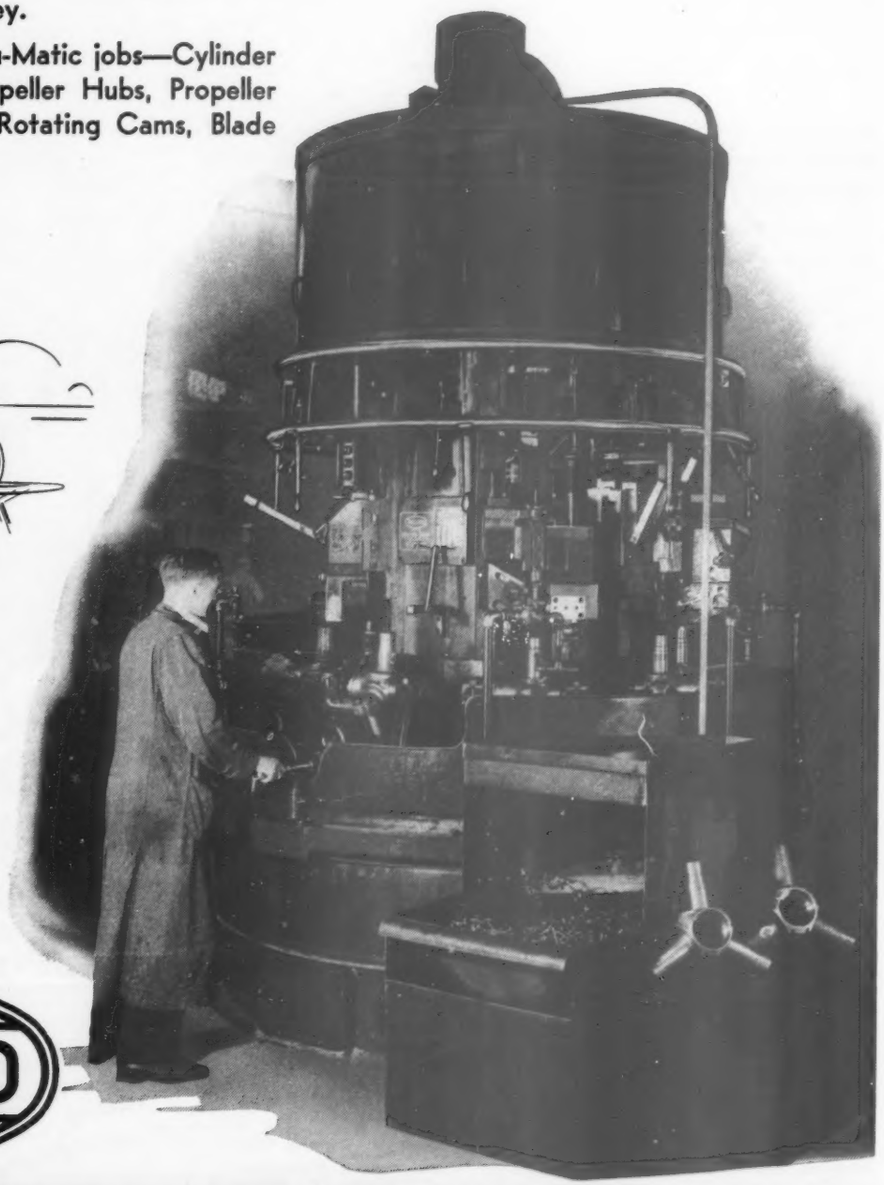
FOR MEN WHO WANT MORE

The plant that bought this machine makes propeller hub spiders—and wants to get them through in a hurry. It is a Bullard 16" 8-Spindle Type "D" Mult-Au-Matic, and it produces a piece every 25 minutes and 30 seconds, instead of in the previous time of 5¼ hours. Here's where the Mult-Au-Matic Method of individual feeds, individual speeds, and simultaneous operation saves time and money.

Here are a few other Mult-Au-Matic jobs—Cylinder Heads, Cylinder Barrels, Propeller Hubs, Propeller Hub Barrels, Stationary and Rotating Cams, Blade Gear Segments, Gear Starter Drive, Cartridge Starters, Pistons, Thrust Sleeves, Intake Cams, Exhaust Cams, Sleeve Driving Gears, and Cam Gear Drive Shafts.

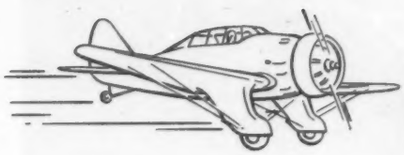
Ask a Bullard Engineer to prepare a Mult-Au-Matic survey for *You*.





BULLARD

THE BULLARD COMPANY

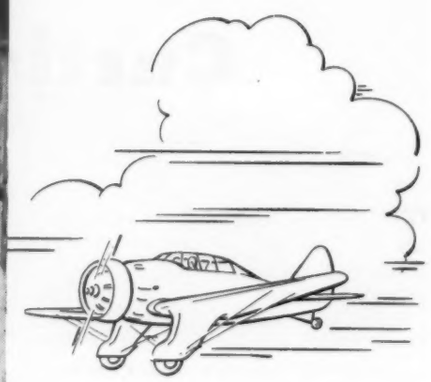


IN LESS TIME . .

For general machinery work, the Aviation Industry selects Bullard Vertical Turret Lathes for their Accuracy and Versatility. The multiple tooling and multiple cutting combined with the advantages of vertical chucking mean money and time saved on every job—single pieces and production orders alike. Proof? The fact that any shop will tell you its V.T.Ls are busy all the time because they are adaptable to so many different jobs. V. T. Ls are built in 5 sizes—24", 36", 42", 54", and 64".

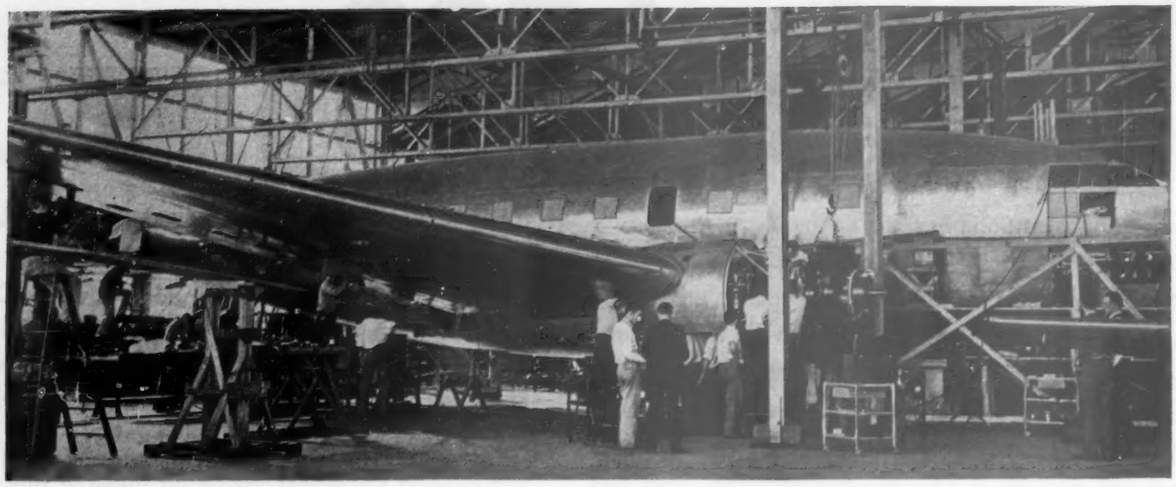
Some of the jobs for these machines are—Crankcase Assembly, Cylinder Barrels, Cam Follower Carriers, Front Main Bearing Supports, Section Diffusers, Supercharger Housings, Cylinder Sleeves, and Crankcase Covers.

Let Bullard Engineers quote on these or any other jobs.



BULLARD

BRIDGEPORT, CONN.



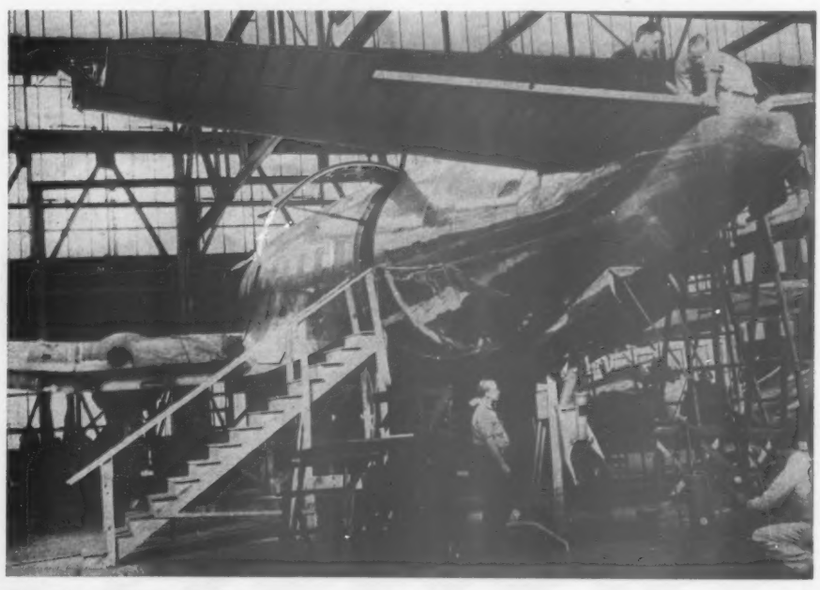
PROGRESS REPORT on
Curtiss-Wright Transport

THE latest addition to Curtiss-Wright's list of commercial and military airplanes, the 36-passenger substratosphere transport, is due for completion in December at the St. Louis Airplane plant. To put on the finishing touches and assemble the last units the fuselage has been raised to level flight position with its nose almost touching the roof beams of the factory.

Included in the specifications of the new ship are the figures that its weight is 38,000 pounds, that the nose to tail length measures 75 feet and that the wing spread is 108 feet. The wings have been permanently attached to the center panel and fitted with de-icer lines and electrical lines for the navigation lights. In each wing two fuel tanks have been installed, having a total fuel capacity of 1,000 gallons, which have been subjected to tests by Civil Aeronautics Authority inspectors to determine their strength and freedom from leakage. Wing flaps and ailerons likewise have been tested under loadings of several tons of lead weights, and are at present being attached.

The horizontal tail surfaces, which have a span of 31.5 feet, have been completed; the stabilizer has been permanently attached and the fabric-covered elevators have been installed and are undergoing tests. The tests consist of loads being applied to the surfaces while they are installed on the airplane. The vertical tail surfaces have also been finished and are being installed.

The hull is complete, even to the installation of cabin windows and doors. However the interior of the cabin contains no passenger equipment so far to permit the installation of flight test equipment, but the pilot's compartment is being completely fitted. Installation of instruments, switches, electrical controls and air controls is proceeding rapidly. Beneath the passenger cabin, in the cargo compartment, the system of rigging for the control cables, and the installation of hydraulic lines and service equipment is being carried out.



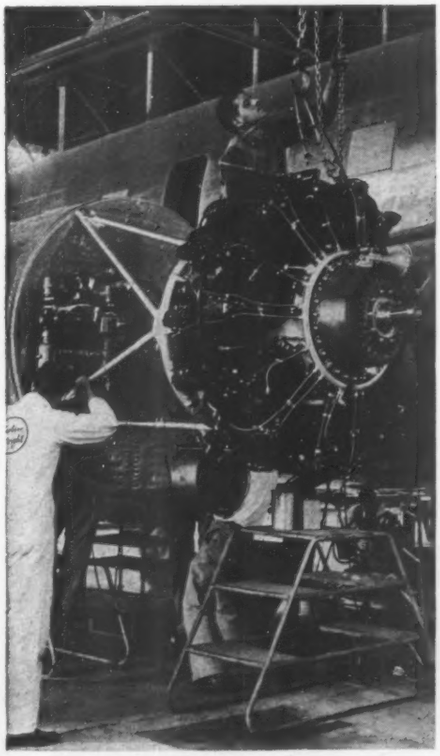
The tail wheel retracting system was tested through the use of an auxiliary hydraulic pump shown in the foreground. The wheel folds back while in flight.

The latter include the hydraulic supply tanks, accumulator tank, auxiliary electric motors, pumps and other equipment to be concentrated in the separate accessory compartment.

The main landing gear and tail wheel have been set up and are in operation. Pending completion of the entire airplane hydraulic system, the main gear and tail unit have been retracted in tests by using a small auxiliary pump and pressure tank as a power supply. To prevent interference with workmen making engine installations inside the landing gear well, the 55 inch wheels were replaced with equivalent lead weights during the tests.

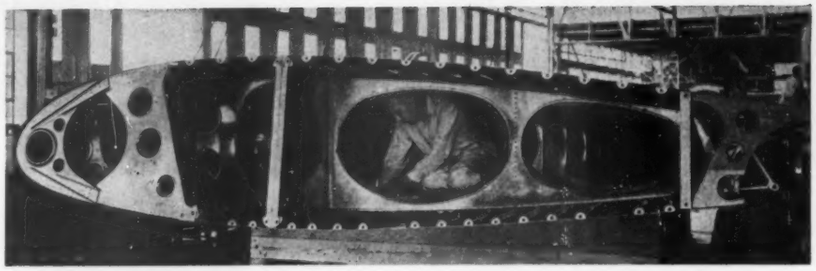
Installation of the two Double-Row Cyclone engines, the last step preceding the inauguration of actual flight tests, is virtually complete. The exact installation was worked out many months ago when an engine was set up on a test stand and subjected to a series of complete tests from which the final installation was developed.

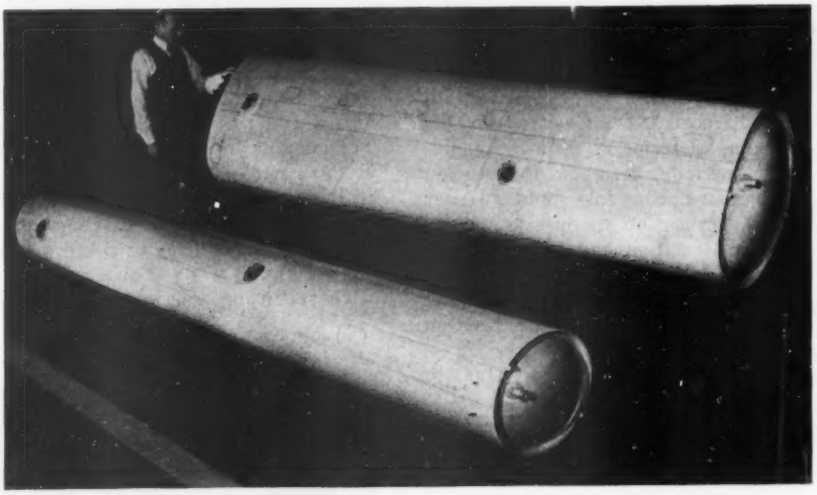
After completion of preliminary flight tests, the pilot's compartment and passenger cabin will be sealed and pressurized for high altitude tests.

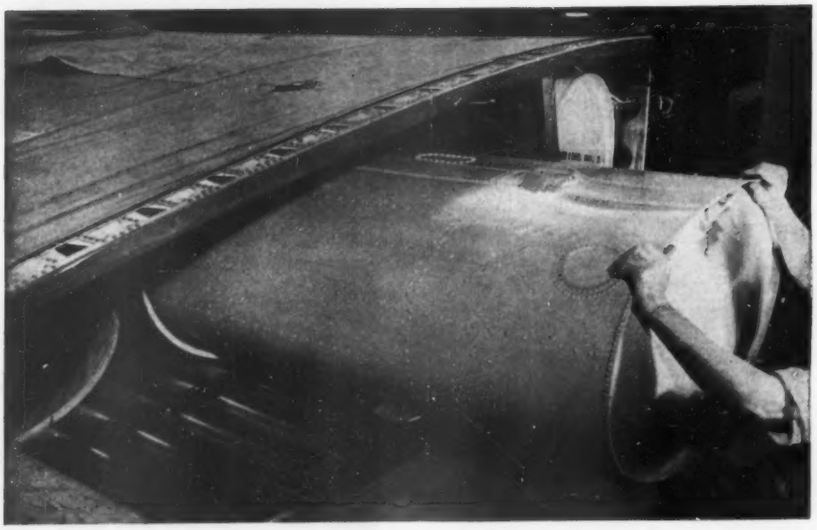


The installation of the Double-Row Cyclone engines was developed on a test stand previous to installing them in the transport. Behind the firewall inside the nacelle is retracted the 55 inch wheel.

Flying Equipment







The cross section of the 108 foot wing has been designed to permit easy installation of the gas tanks. Each wing has one circular and one elliptical tank which fit between the bulkheads in the wing ribs as shown in the bottom photograph. The tanks underwent tests before Civil Aeronautics Authority inspectors insuring their having the necessary strength and freedom from leakage. The total capacity of the four tanks is 1,000 gallons. Placing the tanks in the wings leaves the compartment below the passenger cabin free to accommodate more baggage and affords an easier installation of the auxiliary equipment.

AVIATION RADIO

Dialing the Air Waves with Don Fink

Radio for Solo Instruction

New Orleans Flying Service Develops 31.6 Mc Equipment

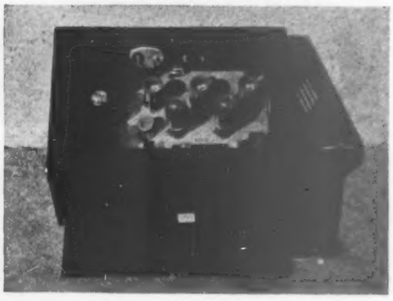
YOUR EDITOR is indebted to C. W. Peters of the radio department of the Hobley-Maynard Air Service, Shushan Airport, New Orleans, for the following description of u-h-f equipment specially designed for student instruction during solo flights. After special permission to operate an experimental station had been obtained from the Federal Communications Commission, the station was put on the air early this year, and has been in use ever since. The authorized transmitter power is 15 watts on 31.6 Mc (about 10 meters).

The station was placed in operation on February 12th last. Many changes have been made, particularly in the receivers used in the aircraft, and while some few details have yet to be worked out, such as the complete elimination of interference caused by the engine ignition systems etc., the equipment is producing excellent results.

Following is a brief description of the equipment in use at the present time. The assigned operating frequency is 31,600 kilocycles. The transmitter is housed in a standard metal cabinet measuring nine by fourteen by twenty inches. The power is supplied by the standard 110 volt a-c power line. The r-f section of the transmitter utilizes one type 6L6 tube connected in a conventional tri-tet circuit, a crystal ground to oscillate at 5,266 2/3 kilocycles and triple the frequency to reach half the output frequency or 15,800 kilocycles. The second tube is also a type 6L6, operating as the final modulated r-f stage and also acts to double the driving frequency to reach the operating frequency of 31,600 kilocycles.

The modulator consists of one type 6N7 tube connected for class B operation, the driver tube is also one type 6N7 tube with triode connection. A single button carbon microphone in this circuit furnishes sufficient power to modulate the final r-f stage very nearly 100 per cent on voice peaks. The antenna in use is a quarter wave vertical, end fed with a 37-ohm concentric cable.

The most generally satisfactory receiver in use, both as to performance and weight, is a small super-regenerative set using one type 6K7 radio frequency amplifier stage, one type 6C5 electron coupled super-regenerative detector, and one type 6F6 (or 6C5) audio output stage. These receivers are housed in a standard metal cabinet seven by six by twelve inches which also include available space for light weight B battery which supplies the plate current. The tube filaments are connected to the 6 volt aircraft battery. The antenna used is about three quarter wave in length and is suspended horizontally between the fin and a small cabane strut placed directly over the rear of the cabin on the small airplanes in use. These receivers have fixed tuning, the only external control being the on-off switch.

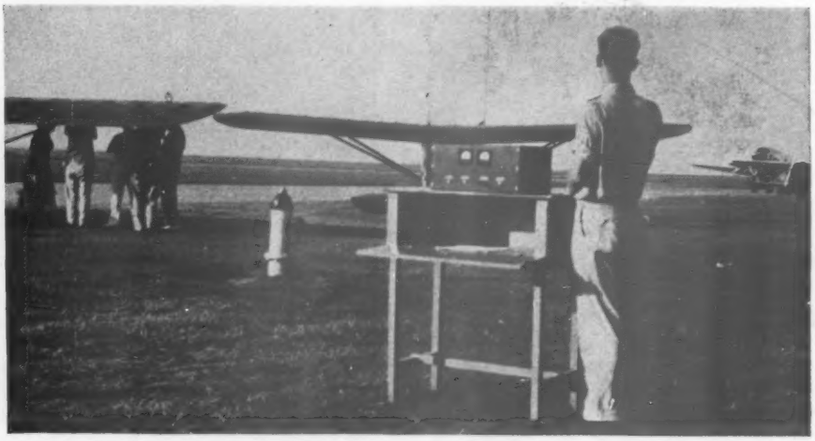


Solo-instruction transmitter used by Hobley-Maynard

For use in larger aircraft, a fixed tuned super-heterodyne receiver is available in which the oscillator is arranged for either electron coupled or crystal frequency control. One i-f stage with the conventional diode detector and two audio stages is used. A jack is provided for plugging a meter into the a-v-c circuit, this meter can be calibrated in "R" units or microvolts and is very useful for measuring transmitter field strength. This receiver operates on 6 volts. The plate current is derived from a special low current vibrator supply of our own design.

The total current required to operate this receiver is somewhat less than four amperes. The receiver is housed in a metal cabinet five by nine by seven inches, the power supply is a separate unit.

It is hoped that the Federal Communications Commission will assign a channel for use by aviation schools, thereby supplying a service to aviation which will add materially to the safety factor in student flying.



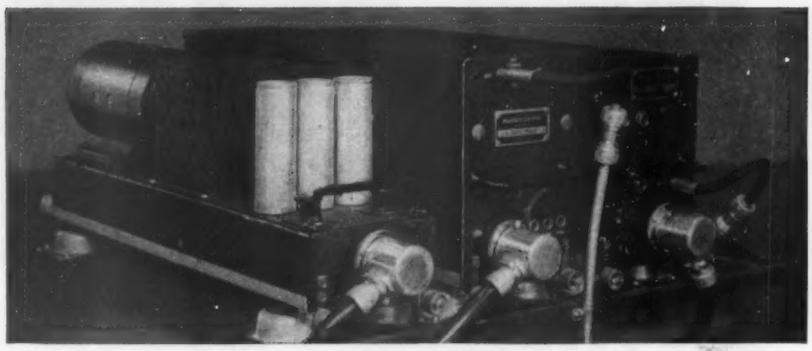
U-h-f instruction communications system set-up at Shushan Airport for an actual test run

Absolute Altimeter

Western Electric Offers Model 1A

THE TERRAIN CLEARANCE INDICATOR announced last year by the Bell Telephone Laboratories has been produced in commercial form by the Western Electric Company and is now offered to the trade. The instrument employs frequency-modulated 500 Mc (60-cm) waves which are radiated from a dipole under one wing of the plane. Part of the energy travels to the ground and is reflected to a receiving dipole under the opposite wing, whereas some of the energy travels directly under the plane from one dipole to the other. The time delay of the reflected wave relative to the underwing wave, introduces a frequency difference between the two (since the transmitted waves are frequency modulated) and this frequency difference is proportional to the height of the plane above ground. The receiver detects the beat note between the waves, and an automatic frequency meter, calibrated in feet, indicates the altitude.

When the instrument was first demonstrated, in 1938, it was rather heavy and bulky, but the engineering applied to it since that time has succeeded in reducing its dimensions and weight considerably. The total weight of the entire equipment (transmitter, frequency modulator, receiver, indicating meter and dipoles) is less than 50 pounds. The equipment is compact enough for easy installation in the baggage compartment of a plane, with plenty of room left over for baggage. No tuning in necessary. The dipole antennas, cable connections to the plane's battery and to the indicating meter, and coaxial transmission lines to the dipoles are the only items which require installation.



Western Electric Type 1A Absolute Altimeter

Multiple-Channels

More Siebenthaler Transmitters for T.W.A.

WORD has been received that a new group of 3-kw transmitters, built by the Siebenthaler division of Aircraft Accessories Corp. for T.W.A., are now in service at Albuquerque, Chicago, Pittsburgh and New York. The transmitters are of the multiple-channel type, rather than the multiple-tuned type, that is, ten complete r-f units are supplied for ten channels, so that the failure of one r-f unit would incapacitate but one of the ten channels. Each of the r-f units is self-contained except for modulation equipment, high voltage power supply and remote control facilities, which are common to all channels.

The remote control system is of the dial type, at present set up with ten digits, but capable of extension to 100 two-digit combinations, which might be used to control not only the channel in use, but the type of transmission (cw or phone) and the power output. At present, the remote control simply selects the desired channel, applies power to it, and connects it to the proper antenna. The transmitters are keyed electronically (that is, by varying the conductance of a keying tube). This permits the transmitters to be used for a variety of high-speed keying functions, including facsimile transmission. Keying is applied directly to the crystal oscillator, and is capable of speeds up to 200 cycles per second. The crystal oscillator output is interrupted by the keying, while the crystal itself oscillates continuously.

In line with current rack and panel assembly practice, each r-f unit is removable completely independently of the others. The units are completely operable in the withdrawn position. Full protection against high voltage is provided by automatic grounding switches. Centrifugal blowers with spun glass filters are provided to maintain low and even temperature in all components.

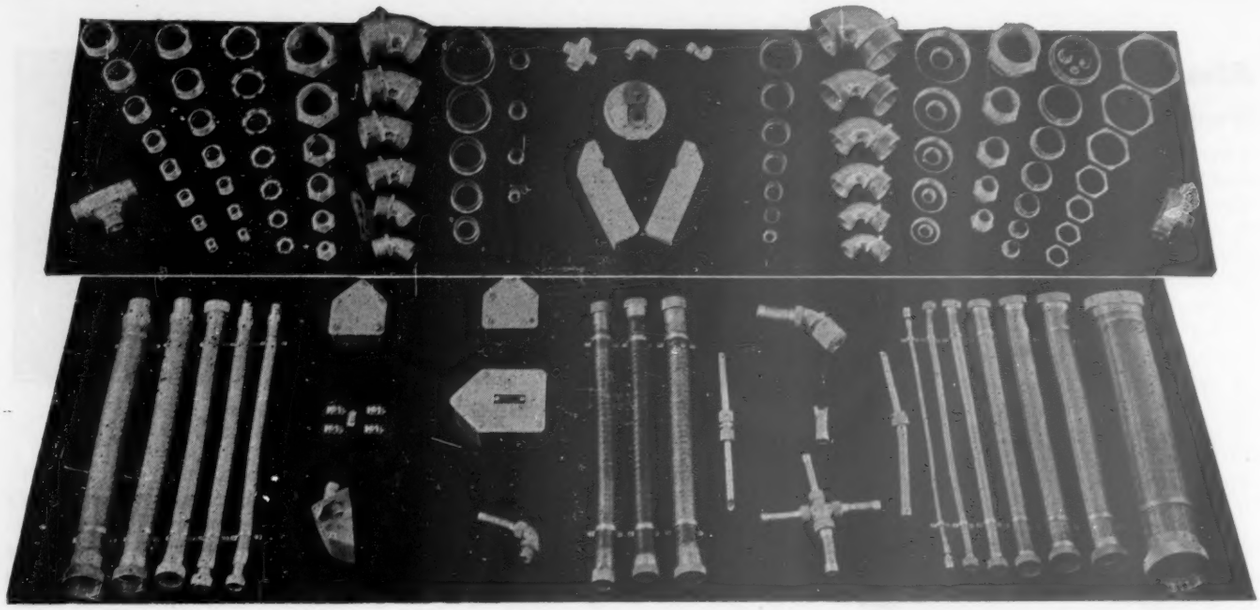
New Taylor Airphone

Transmitter-Receiver weighs 12 pounds complete with all accessories

THE POPULARITY of the beam power tube in small aircraft transmitters has lead to the widespread use of the 6L6 tube for this purpose, but for light weight considerations the newer 6V6 beam tube offers several advantages. These have been capitalized by Taylor Airphone Products, Long Beach (Calif.) Airport in a new two-way aircraft equipment which weighs only 12 pounds, complete with all accessories except the battery. Known as models RT4 (6 volt operation) and RT4A (12-volt operation), the transmitter-receiver equipment itself has the extraordinary low weight of 5.75 pounds. Five tubes are used; two 6V6's for the transmitter, a 6C5, a 6A8 converter and a 6B8 for the receiver. The transmitter is crystal controlled for any one frequency in the 3000–7000 kc band; the standard crystal supplied is for the 3105 kc itinerant frequency. The rated output is 10 watts and the input is 48 watts. The range, with trailing antenna, is 100 miles, with fixed antenna 30 miles. The panel contains an antenna current meter.

The receiver is a superheterodyne with tuning range from 190 to 410 kc, and with a fixed tuning switch which selects the 278-kc airport traffic control frequency at will without disturbing the main tuning setting. Ignition surpression circuits and noise limiter equipment are included. The complete equipment ready to install (price $225) includes the transmitter-receiver unit, vibrator power supply, tubes, vibrator, connecting cables and plugs, Universal aircraft microphone, Trimm headset, AT-cut crystal, fixed antenna kit, and instruction manual.

10-watt Taylor Airphone



Flexible Shielding Conduit and Fittings ... by BREEZE

Breeze offers the most complete line of flexible shielding conduit and fittings, junction boxes and multiple circuit electrical disconnect plugs and sockets that is available.

You can prevent radio interference by shielding the entire electrical system of your plane, from the engine to the tail lights, with Breeze primary and auxiliary shielding.

The Breeze line is a recognized standard in the aircraft industry and is adaptable to the most intricate installations. Special fittings are obtainable to meet any emergency.

Consult Breeze when designing your electrical system . . . remember it conforms to all Government specifications.

BREEZE MARK

Radio Ignition Engine and Auxiliary Shielding • Spark Plug Radio Shieldings • Multiple Circuit Electrical Connectors Flexible Shielding Conduit and Fittings • Conduit Junction Boxes • Cartridge Engine Starters • Dichromate Cartridge Containers •

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THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

DECEMBER 1939

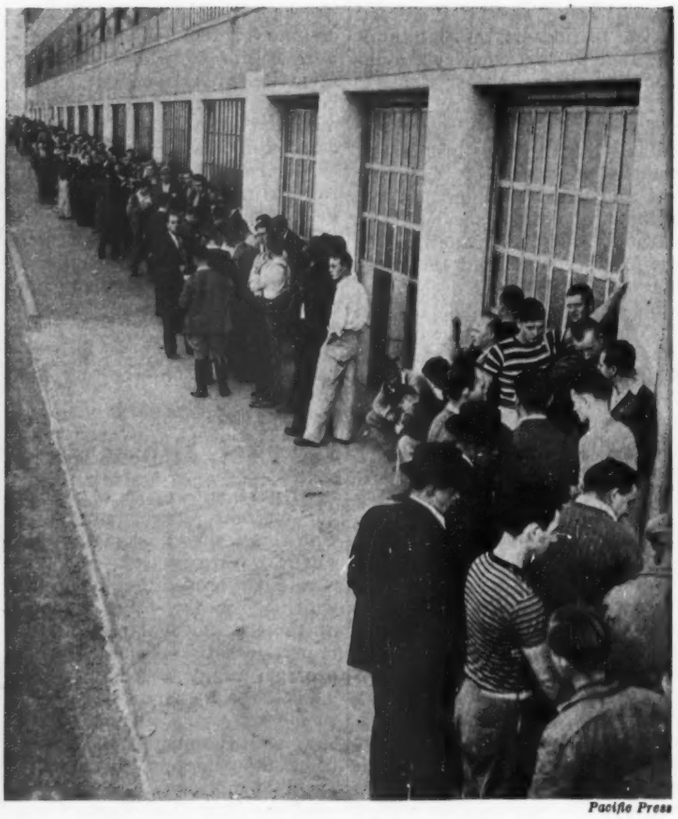
BLAINE STUBBLEFIELD
Washington

C. F. McReynolds, Pacific Coast
Jay P. AuWerter, New York
E. R. Lockin, New York

Airline Safety Pride of U. S. Aviation

(Story on page 78)

International



Pacific Press

AMERICA PAYS FOR DEFENSE to keep Europe's war away, but that makes jobs for U. S. citizens. Ask a Harvard economist if it creates wealth. UPPER LEFT, Navy pitches camp in Puerto Rico, "Gibraltar of the Atlantic," to start its $10,000,000 airbase. Notice the seven PBY boats which daily patrol the mainland coast under the Neutrality law. BELOW, Future fighters of the Air Corps in caterpillar harness start for a training spin. RIGHT, Douglas hires 1600 men and women, breaks all its employment records, heads for a payroll goal of 12,000 by January; 17,000 by June, 1940.

GHQ Air Force

NATIONAL AVIATION

One For The Blue Book

Two or three years ago the standard excuse for numerous airline accidents was "There will aways be accidents." A new comment came along with the advent of the Civil Aeronautics Authority: "Maybe so, but let's not have the same kind over and over." Most men didn't observe the industry's fever chart, but hindsight now shows that it was on trial for its life. Continued fatalities would have been fatal to air travel. Today the safety record of the airlines is the outstanding fact in this country's aviation.

The airlines flew 52,000,000 miles (500,000,000 passenger miles) during the last seven months to November, carrying one and a half million persons, without a serious accident and without a forced landing. In the first six months of 1938 they started 93.86% of scheduled trips and completed 88.44%. In the first half of this year they started 92.24% and completed 92.22%. Obvious conclusion from the last sentence is that trips were started only on sound flight plans. Obviously too, the operators stuck by their cancellation agreement. Total trips in the first half of '38 was 53,134; in the same period '39 the total was 63,160, an increase of 19.88%.

The airlines and CAA like to give each other half the credit. And equal division is fair enough. In conversation at the Air Transport Association's meeting in New York, and in a later conference with CAA it was decided to let well enough alone. For the first time in its history, the system had settled down to the routine use of standard equipment: Douglas, Lockheed, Boeing, etc. The heritage system of pilot replacement had started to function: second officers moving quietly to the left with all the master's wisdom under their hats.

Persons in a position to know say that former Chairman E. J. Noble was a strong contributor to the safety achievement. They say that Noble took a firm stand for immediate and accurate accident publicity instead of the evasive mumbojumbo that was formerly fed to the press, long after it had printed the farmer's version, and all but the widows and orphans had lost interest. Men in the CAA press section, who for ten years had tried without success to convince operators that frankness and not mystery was the thing, had a hand in convincing Mr. Noble.

The Safety Board has made clear and forthright reports, which have been effective in improving stability, in removing weaknesses that have caused structural mechanical, airway aid, and human failures. The public can read exactly what happened, instead of what the farmer says, no mystery about it. And there's merit in multiple-man control. When an operator wants a special cover-up from the press spotlight on his accident, he has to see not one man but eight, none of whom can assume sole responsibility.

Naturally, the management of the airlines have made the biggest contribution. They say that the CAA umpire, protecting them from unscrupulous competition, assuring their companies a living so long as management is prudent, has given them peace of mind to do some back-tracking on the accident question.

You First, Alphonso

Airport subsidy next session of Congress remains uncertain. One thing sure now is that the Federal Government and the municipal association are each waiting for the other to pick up the check. City pride, and in many cases economic need, prompts many a local government to sell bonds and build themselves an airport. But they wait, hoping that a streak of pump priming, or a heat wave of national defense, will send the New Deal Santa Claus to their doorstep with one, all complete. Meanwhile Civil Aeronautics Authority, and many congressmen, are hoping the cities will get so hungry for airports they will actually pay for same. CAA doesn't want to wear out its welcome on Capitol Hill, such as it is, cadging money for other people to spend. Next session of Congress is liable to have a terrific case of economy cramps, in which case, no airport money. On the other hand, if the Army could be induced to complain publicly that it needs about 60 more ports for defense purposes, especially if our peace seems to be threatened, the subsidy deal might be put over.

CAA IN ALASKA: Furthering the program to build up commercial aviation in Alaska, a Fleetwings Seabird, containing $10,000 worth of radio equipment, has been acquired for radio beam expansion.

Push Over Deliveries

After several weeks of intensive study, the State Department finally ruled against fly-away deliveries of aircraft to belligerent buyers, even if manned by foreign crews. Using an application for license under the provisions of the air commerce act as a test case, the department decided such procedure would constitute a military armada, contrary to international law.

Both American manufacturers and foreign purchasers immediately began an investigation to discover some practical method of aircraft deliveries across the Canadian border. Rail freight and inland water facilities offering physical handicaps and delay, a survey of possible borderline airport sites where planes could be rolled across the boundary directed some attention to Sweetgrass, Montana. A designated port of entry, this area was found to be level prairie free of sagebrush and on a line between Great Falls and Lethbridge, Alberta, a stop for Trans-Canada's east-west air service. Topographic studies are also in process at other border points.

Once in Canada, planes large enough to carry adequate gas supplies can legally be flown overseas to Britain and France by foreign pilots.

On the NAA

In Washington, where the National Aeronautic Association holds forth at swanky Du Pont Circle, you hear no end of expert opinion on NAA and what it should and should not do.

It is no secret that for years dissatisfied groups have tried

NYA-AIRCRAFT PLANT PROGRAM: The NYA dignitaries met with the Douglas executives recently and the two organizations decided to put two and two together. Next to the NYA National Administrator Aubrey Williams (white suit) is T. C. McMahon, executive secretary for the Douglas company.

repeatedly to oust the present management and reconstitute the organization. Adding up the criticism, it seems that those who think the NAA has done a good job of keeping records and officiating, but that it has done nothing else worth while, are in the majority.

NAA is supposed to represent the public interest in aviation. This supposition opens two places to put the blame. First, only an infinitesimal handfull of the public is interested in aviation, except as something to read about and to watch on Sunday afternoon. A great many of them use air mail, but Congress represents them pretty well on that. Of course aviation *wants* the country to *get* interested. Aviation would like to get bigger than the five-cent candy bar business, if possible.

PAN-AMERICAN PRIMARIES: Here are four of the Cuban Army's new Stearman Model 73B1 trainers, which are similar to the Air Corps PT-13A primary trainers. Recently a Cuban delegation visited U. S. airplane plants to place orders along with other foreign countries.

But, critics ask, is a supercollosal NAA the thing to do the job? If it is, then the present one ought to be fired, and a new one hired. If not, the one we have should stick to officiating and bookkeeping and stay out of promotion. That pretty much sums up what people think in the Capital.

Not long ago NAA, desperate for something to do, held a conference in Chicago with a miscellaneous group of chamber of commerce men and aviation fans from all over. This meeting recommended bigger appropriations for air mail, $250,000,000 for airport subsidy, authorization of 10,000 airplanes for the Air Corps, with an increase of 1000 a year, and the addition of at least three aircraft research laboratories.

But NAA's opposition still wasn't satisfied with that as a constructive move. A number of the NAA crowd, with some outsiders, held a meeting in New York, a sort of putsch, and announced "steps toward broadening the structure" of the organization, and the choice of Brig. Gen. W. J. Kilner, retired assistant chief of the Air corps, to be "general manager." The news release about this meeting was headed "From the Secretary" of NAA and also from the Du Pont Circle Office, neither of which was true. Okay Mr. Horner and Gen. Kilner, take it away.

See South America First

Now that people are not traveling to Europe, the Government thinks they should be sold on South America. To that end the Department of Commerce called in a group of steamship and airline executives to talk over what could be done. Sec. Harry Hopkins' main idea is to get business men to cruise down there and take an interest in Latin American trade, which this country needs to replace that lost in Europe. Data on the cost of promotion of transatlantic tourist trade is being compiled, for comparison with proposed expenditures on South America ballyhoo. It is pointed out that per day cost of southward travel is less than transatlantic, but of course it takes longer to get somewhere. Be it remembered that Edward J. Noble is undersecretary of commerce, and that promotion of travel on Pan American and on domestic lines connecting with it, will not be overlooked. PAA is cooperating but had not announced any plans. It is probable that the South American countries will join with American transportation concerns in advertising the allure of the Latin lands.

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

Instrument Landing in Two Years Maybe

Instrument landing of scheduled traffic could be in practice on major airports within two years if (1) a standard system is adopted now by the National Academy of Science's committee as requested by the President; (2) personal jealousies and politics are sidetracked; and (3) equipment (as now developed) is promptly produced and pilots put in training. If some responsible agency had assumed coordinative leadership the airplane toboggan track would have been broken in long ago.

Some war officers privately express opinion that the aircraft industry should be nationalized for complete control of production and distribution. The blasphemy leaks to the street and immediately manufacturers and their representatives cry to heaven. They point to present dependence of France on this country for airplanes as eloquent testimony of the results of French government ownership of 51% of the industry. Fantastic concessions had to be made to labor; incéntive disappeared; production fell to near zero. England's shadow-plant system mired down too, had to be jacked up with war pressure; costs are fabulous.

Still seems probable that aeronautical development agencies and manufacturers will not go seriously into plastic structure while the present building rush is on, but the subject is alive and moving along abreast of the times. Activity is revealed in a report by War Department to Congress during the special session. Bendix Aircraft Research received about $100,000 last fiscal year for model and tests of experimental molded basic trainer. North American got $2000 for information on a basic trainer, presumably plastic, and Douglas received $1250 for similar design data.

Safe airplanes are being penalized. Stinson's 105 nonspinner is not wanted by some college instructors. Bellanca's little plane is reported in the same trouble. Theory is if the boys are going to fly nosed-down later on, they better learn that way. The fool-proof clan is settling down to a long fight, but they feel certain of eventual success. Safe airplanes have long been available.

Many heavy planes for the Allies are being crated and shipped; doubt increases as to plans for trans-Atlantic flight delivery. It was said on good authority that the risk of losing a few by enemy attack in the air was less than the risk of losing a boatload by submarine attack or mines. But Great Circle weather is bad now; ferrying may still be done in the Spring; there's little doubt it will be done if the war drags on.

To help celebrate Harry Hopkins' birthday, Chairman Robert Henry Hinckley of CAA wrote and published a book about Bumble the Bee, the little stinger that Ferdinand the Bull sat down on while smelling the flowers. Some people say the Chairman can't draw pictures, but the fly leaf of his book says, "Story and drawings by R. Henry."

Air carriers have placed orders for more than $25,000,000 worth of planes, engines, accessories. If pressure for deliveries to the Allies continues, and if Air Corps expansion is further pushed, question may arise eventually whether domestic air service, national defense, or our belligerent friends, are entitled to priority in delivery of equipment. Col. Edgar S. Gorrell, president of the transport association, has asked the Administration for assurance that civil equipment will be available, but he didn't get it, and probably will not, officially.

Accident Analysis

The Air Safety Board reports 88 accidents for October, four minor affairs contributed by the airlines, and 84 by other civil aviation. Thirteen of the non-airline accidents resulted in fatal injuries, three in serious injuries, 11 in minor injuries, and 57 in no injury to persons.

Spins or stalls preceded five of the fatal accidents. Collision in flight occurred in three instances. There were three structural failures. One of them was caused by dynamic overload in a power dive. One flight ended fatally in bad weather. One of the stall fatalities was caused in part by loading beyond gross weight specifications.

Ninety-seven airplanes were involved in the 88 accidents, nine of which were ground collisions. There were 167 persons involved, 24 of whom received fatal injuries. Fifteen airplanes were destroyed, the rest damaged in various degrees. CAA has a statistical summary.

Night Mail Pick-up

First you see it—now it's gone with the Du Pont air mail picker-upper. Young Richard Du Pont, at Wilmington, Del., is earnestly devoting all his time to development of the pick-up invention of Dr. Lyle S. Adams, which All American Aviation is using on two feeder routes under a special act of Congress. On Nov. 15, after several months of successful operation, the company started night service, using neon lights on the two masts that support the cable, and a range light at a distance of 175 feet. Previously, on October 29, Mr. Du Pont had entertained at dinner a group from CAA, the Post Office, Congress, and the press, who were later delighted at the aplomb with which pilot Holger Hoiriis, three times around, accurately aimed his four-tined trailing hook, which Rep. Jennings Randolph, its legislative papa, says will "bring air mail to the country's doorstep."

Air Training Psychology

First job of the committee of 18 psychologists and doctors that Dean R. Brimhall of CAA has pulled together from colleges and government services to study pilot training and selection methods is to break down the problem into specific research projects. The committee has $100,000 of CAA money to spend and the 10,000 students in the pilot training program to experiment on.

DEFENSE

National Defense Next Congress

Although most Congressmen headed for their home districts immediately after the extra session adjourned, members of committees handling military and naval legislation remained on the job in preparation for an expanded national defense program at the regular session opening Jan. 3.

A group from the military affairs committees left by air to inspect army bases as a guide to additional army defense needs. Already plans are under consideration substantially increasing the standing forces and raising aircraft authorizations. Repr. J. Buell Snyder (D., Pa.) who heads the house appropriations military sub-committee announced his intention of holding out for an air force of at least 8,000 planes. It was learned also that 500 additional flying fortresses will be strongly advocated. Some Congressmen, however, are planning to fight further air corps increases until the current program is completed.

Plans for naval expansion were brought out in more detail when Chairman Carl Vinson (D., Ga.) of the House Naval Affairs Committee, Navy spokesman on Capitol Hill, released advance information on a supplemental navy defense bill which he is expected to introduce early in the session. Hearings are set for January 8. Providing for the largest surface fleet in the world, but without specifying a 2-ocean fleet, the proposed bill would also raise naval aircraft authorizations from "not less than 3,000" to 6,000 planes, add 3 more aircraft carriers to the 8 already approved and allow construction of 36 blimps to supplement the neutrality patrol. Other sections would greatly liberalize procurement procedure.

Present naval air fleet includes about 1500 operating planes, 8 blimps on patrol duty and the laid-up airships, Los Angeles. Acting secretary Edison will favor construction of two or three small dirigibles.

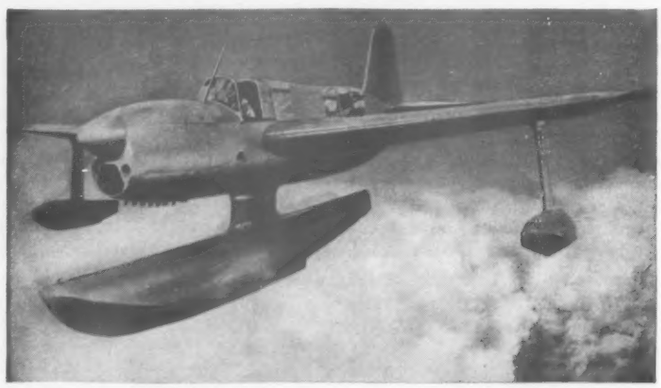
House appropriations subcommittees are scheduled to begin hearings before the end of the year, first on the $275,000,000 deficiency to finance "neutrality" enlargement of Army and Navy personnel, and later on regular Army and Navy budgets.

Meanwhile, defeated isolationists are consolidating their forces for a drive to enact war profits taxation to offset costs of the huge defense program expected. Administration leaders, however, appear to favor economies in other Federal programs rather than a tax on war industries.

Bulk of government aircraft contracts under the present program has already been placed with awards now mostly for engines and equipment. Deliveries of training planes are beginning to come in, with attack bombers expected shortly after the first of the year, pursuit ships during late winter and big bombers in late spring.

To recruit enough pilots to keep pace with the increased number of planes, 2 army boards are scouting northeastern colleges for suitable applicants. News reels of air corps operations are receiving official encouragement to stimulate enrollment.

Meanwhile, both army and navy are pushing forward in air base construction, with army work underway in Peurto Rico, Panama, Florida and at the northeastern air base in Massachusetts, as well as at numerous smaller depots throughout the country. The navy has awarded contracts approaching $30,000,000 for air base expansions in Alaska, the Pacific islands, at Tongue Point, Oregon and Jacksonville. Navy announced that it will immediately construct an air base for at least 24 large boats adjoining Floyd Bennett Field, New York. Cost will be $500,000 to $600,000. Two large hangars will house two independent squadrons, and lean-to space



FOR BATTLESHIPS AND CRUISERS: With wheels and floats interchangeable the experimental Curtiss XSOS3-1 scout observation plane is expected to do big things for the Navy. Performance figures at this time seem to be kept under the official hat.

Wide World

FLYING DOWN TO RIO: As envoys of good will again Flying Fortresses headed to South America. Major General D. C. Emmons (left) commanded, and Lieut. Colonel R. C. Olds (right) lead the seven B-17's to Brazil's 50th anniversary as a Republic.

will be provided for shops and storage. Completion expected March 1.

For the first time in recent years, the navy assigned a squadron of airplanes to battleships operating off the east coast. An unanonunced number were ordered to the USS Arkansas, Texas and New York for patrol duty in the Atlantic.

Under Lt. Col. Robert C. Olds, distinguished for the Buenos Aires flight, 7 army flying fortresses flew to South America to participate in the celebration of Brazil's 50th anniversary as a republic. Added intention was for long-range flight experience and for a demonstration to the world of air power in the Western Hemisphere.

Personal Calls

Anticipating calls at the next session for sizeable increases in army programs, a Congressional group began a personal inspection of army bases in the continental United States and Panama. Postponed by calling of the extra session, the trip finally got underway on November 9 and 18 members of Senate and House committees handling military affairs and war appropriations left Bolling Field in 3 transport airplanes for a 5 weeks' tour.

Stopping at important army posts and air bases along the way, the party headed south, through the Panama Canal Zone and Central American Republics, circling up and west to California and back by way of Washington, Utah and north central States to the New England area.

In addition to regular army installations, the Congressmen inspected aircraft manufacturing plants near San Diego and Los Angeles and visited west coast civil aviation schools.

Stated purpose of the trip was to learn at first hand how the present national defense program is developing and what additional needs of the military forces should be met.

U. S. Program First

Close supervision of military aircraft purchases by both Federal and foreign buyers has been undertaken by an interdepartmental group working in cooperation with the Army-Navy Munitions Board. Purpose of this activity is to assure completion of our own national defense program prior to foreign business and to stimulate sound industrial expansion in the name of defense.

To this end efforts are concentrated on spreading contracts among manufacturers throughout the country, achieved partly through offering advice to foreign buyers interested in placing war orders. The government emphasizes that no compulsion will be exerted on industry in this connection; that the main objective is to provide a centralized information service.

Since the revised army-navy aircraft release policy requests a report from aircraft companies as to all contracts and negotiations on contracts, the committee is equipped at all times to inform foreign purchasers of production facilities available.

At present the War and Navy Departments are confident their plane contracts will be completed on schedule, by reason of penalty clauses and the supposition that producers would be reluctant to risk loss of future business through delays or failures in deliveries under existing orders. It is understood, however, that the interdepartmental group is aware that in future national defense programs, Federal priority may become more of an issue.

Secret Secrecy

To the casual observer it may appear as if the aircraft release policy of Army and Navy, permitting almost anything in production to be exported, is throwing military secrecy to the winds in an effort to help the Allies. This however is not the case. The decision whether or not to release a given piece of equipment for export is based on two primary considerations.

The first is whether efforts toward secrecy would be successful. Hundreds of people who work in airplane factories know a great deal about the product, and of course they can't all be trusted. Military airplanes are flown all over the country and in foreign lands, where many interested foreigners have opportunity to see them. Thus in many cases there is no point in trying to maintain secrecy.

The second consideration is that, if a type is released for export, production will be greatly increased, which reduces cost of the model to our own government.

Still, many technological secrets can be, and are, kept exclusively within the Services for years on end. One outstanding example is the Air Corps' bomb sight, which has been proved far superior to anything else in the world. Apparently no one outside the inner shrines knows how it works.

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AVIATION ABROAD

Scraps About Big Scrap

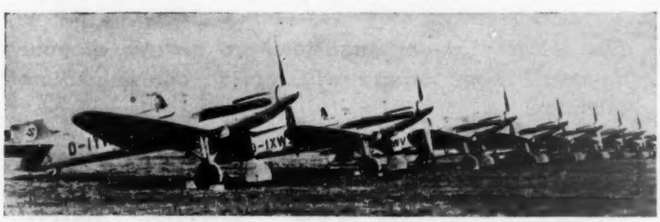
Our monthly progress report on the war is still pretty much a collection of miscellaneous scraps. It would be nice to report some astonishing news like British production having reached 17,409 ships per month or that the real reason the Germans haven't blown down London is the number of failures they've had with ersatz propellers made from laminations of pumpernickel and cream cheese, but we don't pretend to have the infallible answer to What Is Behind It All.

Scrap No. 1 is that there are a lot of airplanes in this war doing things they weren't really designed for, and that goes for their crews too, who aren't on the jobs they were trained for. The biggest switch is the general use by both sides of their high performance bombers for long distance reconnaissance. Their range and speed make them fit the job fairly well, but their layout and equipment aren't very good for long observation work. The few ships specially designed for this purpose, like the Avro Ansons, apparently don't have what it takes to get away from trouble if it turns up.

Scrap No. 2 is the surprising distance these bombers on reconnaisance missions have been able to fly over countries with well organized air defences (and this holds for both sides) and get back safely as long as they follow the rule of keeping out of fights and running from trouble. While the few small-scale bombing raids attempted so far have shown losses running around 30%, it's also been proved over and over again that a single ship taking advantage of clouds and even keeping right down on the trees at times is a mighty hard thing to find and shoot down even when it's known to be somewhere around.

It's beginning to look as if there's some truth in the complaints heard the last few years that fighters were getting too fast for their own good, at least as far as taking on other fighters goes. It's another case of something they weren't designed for, as most of the types in use were really meant for interceptors. They have all the speed and climb that could be built in them, but since the bombers they were intended to attack were supposed to keep on straight and level, maneuverability wasn't put near the top of the list of requirements. Probably the hottest ones are fine for their intended purpose, but in the dogfighting that's developed at the front they've apparently been outfought by slower but more maneuverable ships. Remember the war in Spain, where the Italians claimed their Fiat biplanes had it all over the faster Russians when the two tangled. Either the hot ships will develop some new fighting tactics in which their speed will count for more, or you can expect two specialized types of fighters to emerge, one for taking on other fighters and the other for interception work.

LEST THEY FORGET: Holland is following suit in the neutrality bridge game by quietly building up her air force. Bristol Hercules powered Fokker T.9's like this one have been sent to the Dutch East Indian Air Force.



AT THE FRONT: From what comes through the censor's hands and typewriter reports have Heinkels on active duty along the lines. Its doubtful, however, if they're housed like this.

Student Gets 10 Months

Raising an air force has been on Britain's mind for so long that recruiting and training methods haven't been changed much by the war. One new step has been added at the beginning of the recruit's career; he is first sent to an Initial Training Wing, where he does no flying but is built up physically, taught some drill, and put through a ground school course. After that he goes to an Elementary and Reserve Training School, which is operated by a civilian company. Here he is brought up through the solo stage in a trainer, given a lot more ground school, and then passed on to an R.A.F. Flying Training School. This gives him a conversion course to service ships, teaches him military flying, and hands him over as a finished product to a regular R.A.F. squadron. Before the war this course took ten months; it's probably about the same now.

Club flying has been indefinitely suspended even in the western part of the country outside the prohibited zone, and no training is going on except under the system above. This probably makes for better efficiency and uniformity, but so far the club ships are grounded without any use being made of them. Since a lot of the clubs are in a bad financial hole (most of them went hog-wild on expansion when the CAG plan started and now haven't any source of income) there's a campaign on to get the government to buy up all their ships for trainers. A similar scheme was followed in Australia.

For the long pull, plans are going ahead for schools in Canada to train the Australians and New Zealanders as well as the Canadians. Recruits will probably also be sent over to them from Britain if things over there get too lively. According to the original announcements 25,000 pilots were to be turned out the first year, but the way things look now the plan won't be as mammoth to start with as the first reports called for. For one thing, the Canadians were to be paid so much a head by the governments concerned for men trained, but they were expected to lay out around $500,000,000 to set up and equip the schools. This would leave them holding quite a bag if the war ended before many pilots were turned out. Until next spring at least the great Empire Air Scheme will probably run on a fairly sport model basis. No new fields will be constructed, but barracks will be built at existing airports to handle the recruits. The British are apparently going to furnish the trainers (most likely from new orders in the U.S.), all of which will cut down Canada's investment until she can figure out what kind of a war this is going to be.

Keep Airlines Going

The world airline map doesn't show many changes from last month. However, one point worth noticing is the effort in Europe by both belligerents and neutrals to keep their lines going and even to expand in the two important sections now on the political sidelines—the Balkans and the Baltic. The Dutch, Belgians, and Scandinavians are all tied up together, giving a lineup of neutral lines that extends from Britain to Moscow. ABA, incidentally, is keeping its pool service with Russia open all winter this year for the first time. British Airways runs through as far as Finland, and Deutsche Lufthansa is keeping up most of its lines around the Baltic. Beside the present one through Holland, Britain is soon to get another and more direct neutral connection to Scandinavia when ABA and Norske Luftfartelskap start their Stockholm-Aberdeen run. In the Mediterranean area Italy is back to about the same network she had before the war, while her lines into the Balkans are increasing in importance. The Germans have restored their Balkan route through Belgrade to Sofia, and the Russians are expected in those parts any day now. Papers are supposed to have already been signed for the Russian line as far as Sofia.

The two big neutral colonial routes, SABENA and KLM, have both been stymied by

French unwillingness to let foreign lines run across her territory. KLM has been using Naples as the western end of the Batavia line; the worst part of it is that the line is cut off from its maintenance base in Amsterdam. The Germans, however, are said to have offered KLM passage rights recently, which may straighten things out if the deal goes through. A Naples-Lisbon route to connect KLM with Pan American is also rumored; France too is planning a run to Lisbon to speed up her transatlantic mail. SABENA, while unable to get through from the Congo to Brussels, has received rights for an extension down through South Africa to Cape Town, something they've been dickering for a long time. In return South African Airways will fly into the Belgian Congo.

New Lines Despite Wars

The war isn't holding up airline progress in a number of countries which to date haven't been very prominent. In Europe, the Baltic states are just getting their first home-owned international lines under way. Estonia has bought some Ju52s for services to Sweden and Finland, while a Lithuanian company has begun a run to Riga in Latvia. Spain has announced that it's going to have its own lines; up to now the Iberia line, a sort of second cousin of Lufthansa and a hangover from the civil war, has been the only domestic operator, although Ala Littoria flies a number of routes into the country and is supposed to have the inside track on setting up any internal lines that are needed. The Spanish air minister, General Yague, says that the new setup will not only be a Spanish owned and operated affair, but also will use Spanish ships. At that rate it may be some time before he gets his line going. Switzerland must be about the only European country left without any foreign air connections; Swissair has shut up shop and put its ships in cold storage. Their best bet for restoration of service looks like a tieup with Italy, particularly since the war seems to have brought the two countries a lot closer commercially.

On the other side of the world Japan is planning big things for 1940. Instead of importing Focke-Wulf Condors for the line to their mandated islands, the Japanese figure now to build their own ships for the run. A number of other commercial ships are scheduled for production next year, along with a big 4 engined job due in 1941 (Japanese-built DC4?). They are busy again trying to arrange a connection with Pan American's transpacific line; the latest scheme calls for mail and passengers to take a 7 hour boat ride between Guam and Saipan, one of the Japanese islands. This would avoid the necessity of Japanese planes entering U.S. territory and vice versa, and if it goes through would furnish some traffic for their Pacific island route, now the world's most economically unjustified airline.

More locally-owned lines are also beginning to appear in South America. An Argentine company, Sociedad Argentina de Navegacion Aerea, has been organized to run a service between Buenos Aires and Colonia, Uruguay, using Sikorsky S38s. In Chile the Linea Aerea Nacional has been reorganized; the government is expected to get behind it with enough cash for some new equipment (it bought some Junkers Ju86s this year but needs more ships) and better ground facilities. A substantial subsidy boost will probably be handed it to keep it out of the financial troubles that have dogged it most of its life.

War-Baby Airplanes

Along with promoting their airlines, the war has also given a boost all around to the aircraft industry in countries that formerly imported most of their ships. In Holland, Fokker's return to making commercial ships is mentioned elsewhere; there are signs that the Dutch are trying to hold down their military imports to rush orders and throw as much business as possible to domestic producers like Fokker and Koolhoven. In Sweden the two plants of Svenska Aeroplan are full up with an order for Ju86K bombers being built under license. They are to be enlarged as soon as possible to take care of the big increase in the Swedish air force that is being asked by the government. The Swiss aircraft works at Thun is busy with some very hot looking two seat general purpose ships with Hispano Suiza 12Y engines, cannons, and plenty of machine guns. The Finnish State Aircraft Factory is building a fighter trainer to take a Wright Whirlwind engine. In Argentina the government aircraft factory at Cordoba, which has built Focke-Wulf trainers, is now turning out Curtiss fighters under license. They figure on doing a good business with other South American countries when their own needs are filled. Another sign that Argentina is really going into the business is the establishment of an aeronautical engineering course at the University of Cordoba.

AS OTHERS FLY IT

Nazi-Soviet Airline Doubtful

The old Eurasia plan for a joint Russian-German (with the accent on the German) line to the Far East has been revived in Germany, but the resurrection talk has so far been full of wishful thinking. Those who are tooting it up as Wartime Project A for Lufthansa say East Asia is just about ready to settle down politically and economically, and is ripe for an extensive foreign-promoted airline network. About all we can say on that point is that they must read different newspapers than we do. Even if the plan is a long pull one to keep Germany's foot in the door of a region she's now cut off from, there's no evidence that the Russians are superanxious to help out.

The Italian South Atlantic line, which a short while ago was written off as a war victim before it even got started, is showing signs of life. Its Argentine feeder, Corporacion Sudamericana de Servicios Aereos, has squared itself with the Argentine government after a short suspension for being too Italian. It's now back on the job and planning some expansion, having been given a good bit of Argentinizing in personnel and financial control. To operate the transatlantic line a new company, Linee Aeree Transcontinentali Italiane, has been set up, probably as a subsidiary of Ala Littoria which did the survey work. Plans call for S. M. 83s to make the run via Malaga, Rio de Oro, the Cape Verde islands, Recife, and Rio de Janeiro. All this is supposed to get going this winter; flying rights in South America may be withdrawn if the service doesn't start before long. Now that the French are back on the South Atlantic again, there are plenty of signs that the European countries aren't going to let their South American trade slip for lack of air communication.

Export business as usual may not quite be the German motto, but they've certainly been doing a pretty good trade even in wartime with those who have products Germany needs. With the neutrals all looking for quick deliveries of military ships, the Germans have been able to turn better deals for the Fatherland by offering them than the British and French could turn with cash money. The Balkans in particular have seen a lot of this kind of business. A bunch of Messerschmitt fighters have already gone to Yugoslavia, with more promised. Heinkel fighters are being supplied to Rumania in return for oil and wheat. Sweden has received Hell5 torpedo planes, and Switzerland trainers. The Bulgarians are said to be getting lots of ships turned out in Bohemia-Moravia, and there are stories that the Germans are using the factories there specially for the export trade, in some cases keeping on with the same types that were built for the Czechoslovak Air Force.

KLM got a fine birthday present when the Dutch government came across with some funds to ease its money troubles just as the line was celebrating its 20 year mark. For the past few years KLM has been laying out for equipment and expansion at a rate that took a lot of cash. In 1938 the gov't had to help out with a 2,500,000 guilder loan (around $1,700,000). KLM's ambitious plans for still newer and hotter equipment on the East Indies run to cut the Amsterdam-Batavia time to 2½ days, plus expansion all around that may include the Atlantic, call for digging up a lot of money. The Dutch post office has done its share by granting an extra $1,150,000 annually for 5 years beginning in 1940. Now the government has asked the Dutch parliament to let down another $2,000,000 loan, most of which will probably be earmarked for equipment. It looks as if Fokker had a finger in the pie somewhere, since they were in on the conferences between KLM and the government, and the loan news was accompanied by rumors that one of the conditions was that KLM should buy some home-grown ships.

AVIATION PEOPLE

PRESIDENT'S ASSISTANT: H. Oliver West has just been appointed P. G. Johnson's assistant at the Boeing Aircraft Co. He has been in the aviation industry for eighteen years, most of them having been with Boeing, the last few with Trans-Canada Air Lines.

TOUR COMPLETED: J. E. Sullivan has recently made a tour of the Army, Navy, and commercial overhaul depots. Besides being a Lieut. Cmdr. in the Naval Air Reserve he is well known for his research and activities in aircraft materials and equipment.

Wide World

AT THE NEW YORK NAA DINNER: The Greater New York Chapter of the National Aeronautic Association held a dinner not so long ago starting the 39–40 season. The dignitaries that helped sum up the aircraft industry as speakers of the evening were: (left to right) R. Leslie Cizek, president of the chapter; Roger M. Coombs, Jr.; I. F. Randall, T.W.A. director and president of the U.S. Aviation Building at the New York World's Fair, and John H. Jouett, president of the Aeronautical Chamber of Commerce of America.

FOR TEN YEARS SERVICE: The decorations are being handed out by Guy W. Vaughan (left), president of Wright Aeronautical and the Curtiss-Wright Corporation, to Myron B. Gordon, Wright vice president and general manager, for his being with the company for the past ten years. The pin is the official 10-year service pin, and the occasion was the luncheon which this year marked the 20th Anniversary of the company. Just before this Vaughan himself had received another official pin for his fifteen years connection with Wright. Previous to becoming president of Curtiss-Wright, Vaughan was head of Wright Aeronautical.

MANAGER: The new manager of the Aircraft Division for the Continental Motors Corporation is A. W. Wild. He has been with Continental for fifteen years, starting in the engineering department and has since handled marine, machine products and automotive sales, was also Advertising Manager for several years.

GENERAL MANAGER: Well known as Chief of Engineering and Maintenance for Boston & Maine Airways, Inc., Clarence M. Belinn has resigned to be general manager of Kansas City Southern Transport Co., Inc. KCST's application before the CAA proposes operation with Lockheed Lodestars, Kansas City to New Orleans.

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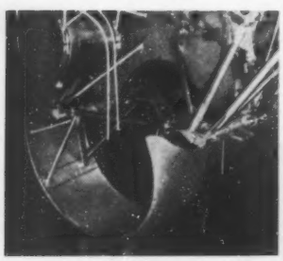
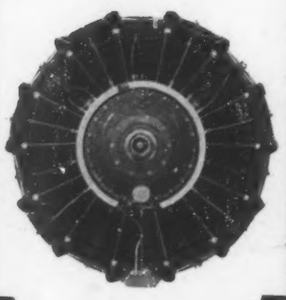
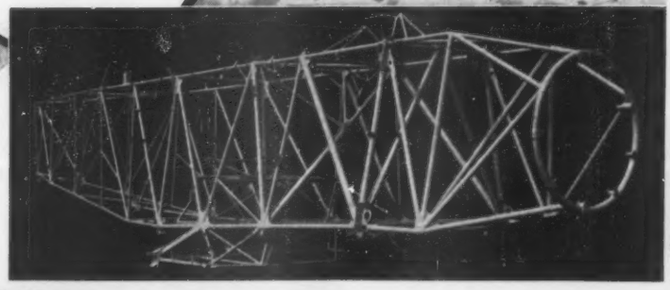






The OHIO SEAMLESS TUBE CO.
OHIO SPECIAL QUALITY
Shelby, OHIO

CHROME MOLYBDENUM FOR STRENGTH LIGHTNESS AND SAFETY

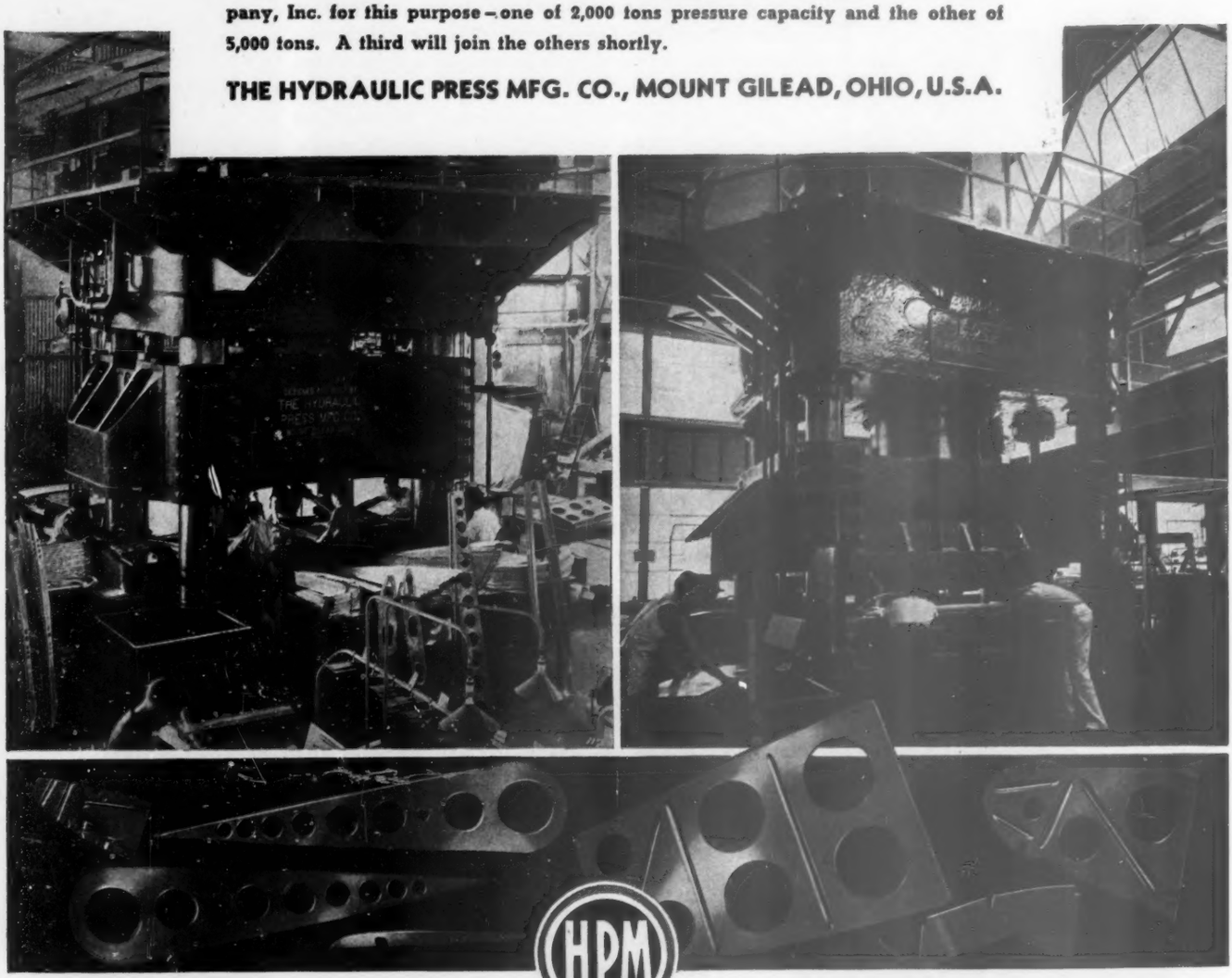
SHARING IN THE *Progress* OF MODERN AIRCRAFT

Bringing mass production methods to the aircraft industry was inconceivable several years ago—yet this has been accomplished with the thousands of small duralumin parts used in fabricating the modern Douglas aircraft—in spite of limited runs.

H-P-M FASTRAVERSE PRESSES plus the ingenuity of Douglas Engineers have been responsible for this—enabling the production division to group many different shapes and sizes over a large pressing area and form all of them at a single pressing.

Two H-P-M FASTRAVERSE PRESSES have been installed by Douglas Aircraft Company, Inc. for this purpose—one of 2,000 tons pressure capacity and the other of 5,000 tons. A third will join the others shortly.

THE HYDRAULIC PRESS MFG. CO., MOUNT GILEAD, OHIO, U.S.A.



HPM

FASTRAVERSE PRESSES

WITH THEIR EXCLUSIVE *Closed Circuit* SYSTEM

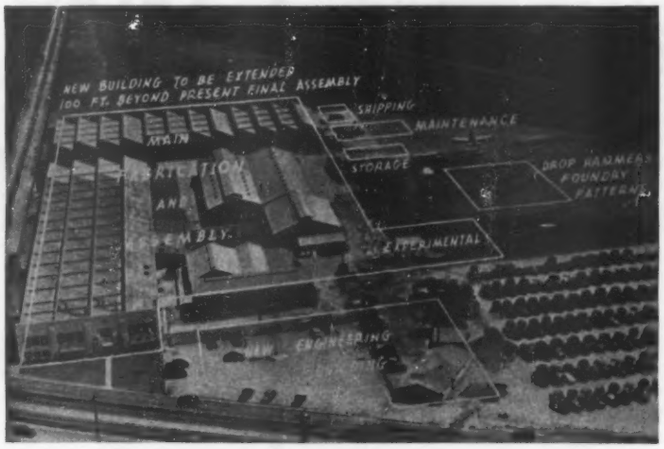
AVIATION MANUFACTURING

Encouraging Expansion

U. S. and foreign governments are both taking steps to expand production capacity to meet allied war needs. As previously reported, France and Britain will pay for new plant in the form of deliberately inflated prices on aircraft. To make absolutely sure, however, that there be no delays, the French have advanced a total of $5,000,000 to United Aircraft and to Curtiss-Wright so that engine plant expansions can start immediately. The advance payment will later be charged off against the extra payments. Similar arrangements with other companies are likely when the British come into the market in a big way, but probably not until then.

Meanwhile the President, the Army and the Navy are getting together on a scheme to protect manufacturers against the heavy taxes they risk on useless plant after the war through such deals with the allies. Whenever a showing can be made that the added plant will aid the national defense if we get into war, the Treasury will permit very rapid depreciation of the plant—leaving it at war's end with no book value and hence no taxes to pay. Abuse of the plan will be automatically prevented, it is thought, because if the plan is followed with plant still useful in the future, income taxes would be very high. It is understood to be this point that has deterred manufacturers from taking advantage of a similar scheme worked out in connection with U. S. defense purchasing (under the 12% profit limitation). With expansion of aircraft production capacity constantly accelerating, the Aeronautical Chamber of Commerce recently announced that airplane factory space expanded by 17 per cent during the first half of 1939—from 6,000,000 sq. ft. to 7,025,000—which, with expansions in more recent months, brought November estimated capacity to 1,250 planes per month. Space devoted to airplane engine factories increased during the same period from 1,670,000 to 2,004,000—20 per cent.

Plant expansions announced last month included a new assembly building and offices at Curtiss-Wright's Tonawanda, N. Y., plant to cost $232,000.



WHAT VULTEE WILL LOOK LIKE: You won't recognize the Vultee plant after the bricklayers get through with it. The new buildings are going to follow the white lines on the photograph which seem to indicate an increase in size.

At the same time, Curtiss added about 60 per cent to the floor space available for its propeller division when it bought the hollow steel blade manufacturing division of the Pittsburgh Screw and Bolt Co. Only two months previously Curtiss added 50 per cent to its Clifton, N. J. propeller division. The new plant manufactures hollow steel blades, whereas Curtiss has previously concentrated on aluminum alloys.

Another ownership reshuffle got underway early in the month when Lycoming Manufacturing, engine-building subsidiary of Auburn Auto, merged with the Aviation Corp. The move will provide new working capital for Lycoming and permit Aviation Corp. to extend its business, concentrating operations in one location, without building new plant.

At Nashville, before Aviation Manufacturing Corp. had even completed excavation for its new plant there, it announced extensions of its original plans. Present intention is to provide 145,000 sq. ft. of which 125,000 will be devoted to manufacturing. The manufacturing unit, with three production lines, will be airconditioned.

In Detroit, meanwhile, report has it that both Barkley-Grow and Stinson are laying plans for early expansions of plant.

With award of $3,000,000 Air Corps order for basic trainers, Vultee began work on its 100% plant expansion, involving $200,000 worth of new equipment.

Aeronautical Chamber estimates U. S. plants could produce 16,000 engines a year. Within 1940 they could build 25,000 of 1000 h.p. each, plus meeting light engine requirements. Expansion has been in progress two years. Floor space has increased 32%.

Orders Under The Hat

Huge orders for airplanes are being placed here by France, and some by England. That is about the only real fact available. All of those nice columns of foreign and backlog orders added up in the newspapers, like bank balances, are speculative. In fact some of them come from banks which are backing the boom, and some come from stock speculators.

So rigid is the War Department's secrecy order that even the Aeronautical Chamber of Commerce in Washington admits it doesn't know the facts, and cannot release what little data it has. It is true that some manufacturers issue press statements about their foreign and backlog orders, but if you take a second look you notice they are just big round figures and that the statements are vague.

A conservative estimate places total unfilled orders of American manufacturers at $550,000,000, of which about half is believed to be export. Highest estimates place the figure at $650,000,000. A fairly safe guess is that whatever the figure is now, it will reach a billion when the Allies get their throttle wide open—if the war goes on.

Conservatives say that foreign buying is not up to bullish guesses. They say the Allies are trying to conserve their available exchange, especially England. Diplomatic rumor has it that our plant capacity has been assigned to France, while England is depending more on her own shadow system.

Among the few figures that can be pinned down is one in a press release that Douglas has a backlog of $78,000,000; $35,000,000 of which is foreign military. Curtis-Wright has a French order, reported in the neighborhood of $60,000,000. Lockheed denies that it has received any foreign orders, since repeal of the embargo, except the $5,000,000 Australian purchase; the 250-ship British order on its books is nearly completed.

West Coast Business

Vega Airplane Co. has applied for listing on the Los Angeles and San Francisco exchanges of 460,000 shares of its $1.50 par common stock. Vega is a subsidiary of Lockheed Aircraft, which owns 231,667 shares of the 460,000 to be listed. . . . Ryan Aeronautical Company's additional Army orders for training and observation planes brings total Air Corps business for the year to Nov. 1st to approximately $800,000. . . . Sale of 250,000 shares of stock of Northrop Aircraft, Inc. netted the company $1,250,000, of which $600,000 is being expended for a new factory and machinery. The new plant, located in Hawthorne, Calif., is to be completed in December, and preliminary production is expected to start about Jan. 1, on a light military plane. Northrop is reported negotiating with domestic and foreign buyers of military equipment. Plans call for early employment of about 1,000 men. . . . Air Transport Manufacturing Co. has approval of an issue of 225,000 shares of stock by the California Corporation Commissioner. Stock is offered at $1 a common share. The firm has specialized in rebuilding light transport aircraft and is currently engaged in developing a training type plane. . . . A special meeting of Menasco Manufacturing Co. stockholders has been called to vote an increase of capitalization from 750,000 to 1,000,000 shares. The

company is maintaining regular deliveries on light engines of the C-4 type, developing 125 hp., and the C-4-S of 150 hp. Recent orders have included 30 engines for Ryan Aeronautical Co., and 12 engines for Latvia, with an option on 12 more. Also in production is the Unitwin engine unit, with two 6-cylinder engines driving a single propeller, which is being used by Vega Airplane Co. to power its Starliner. . . . Recent Douglas orders include 15 single-engined attack bombers for the Kingdom of Iraq, and a French order for an additional number of 250 twin-engined attack bombers. . . . Airplane Manufacturing & Supply Corp. has filed registration statement with SEC covering 210,000 shares of $1 par value common stock. The new company, not yet operating, proposes to acquire from Earl Herring an option agreement with Bendix Aviation Ltd., to buy Pacific Airmotive, a Bendix division, and Airplane Parts & Supplies, also a Bendix subsidiary.

Lockheed Personnel & Finance

Gardner W. Carr, who has served as president of Menasco Manufacturing Company, vice president and general manager of the Glenn L. Martin Company; and vice president in charge of manufacturing for the Boeing Airplane Company, has been named head of the Production Control Department of Lockheed Aircraft Corporation.

Operations for the nine months period ended September 30th, last, resulted in net sales of $23,975,523, according to an announcement by Robert E. Gross, president. This represents an increase of 201 per cent over the $7,956,527 reported for the same period of 1938, and is more than double the sales volume for the entire year of 1938, $10,274,503. Backlog of unfilled orders is currently reported in excess of $30,000,000, including recent orders for $250,000 of the recently announced "Lodestar" 17-place model, and $160,000 for three Model 12 transports.

Wage-Hour Law

Decision by the Wage-Hour Division of the Labor Department that the law applies to makers of tools, dies, patterns, designs, blueprints, etc., which do not go into interstate commerce, but which are to be used in the production of goods for interstate commerce, is interpreted by observers here as applying to all civil aircraft manufacturing.

Plastics For Pursuits

Timm Aircraft Corp., Van Nuys, Calif., is reported entering a major development program financed by recent offering of 425,000 shares of $1 par value stock at $1 per share. Funds raised are to cover purchase of all design and manufacturing rights to the Hughes high-speed airplane developed by Howard Hughes, and which still holds the transcontinental speed record, 7 hr. 32 minutes 27 seconds, and the American landplane speed record of 352.388 mph. Redesigned to serve as a military plane, the Hughes ship will be powered with 750 and 1050 hp. engines, and it is believed the military model will materially exceed the speed established by the present experimental plane.

According to R. A. Powell, vice-president and general manager of the Timm Aircraft Corp., a major development program is also being conducted with plastics.

New Military Orders

Army

Allison Engineering Co., $1,851,631.65, airplane engines

Continental Motors Corp., $294,200.85, airplane engines

Pratt & Whitney, $12,834,105, airplane engines

Jacobs Aircraft Engine Co., $360,000, Model R 755-7 engines of 225 H.P.

United Aircraft Corp., $200,010, propeller assemblies and control governors

Aluminum Company of America, $70,729.49, aluminum alloy, bars, rods, sheets, etc

Cheney Brothers, $133,800, parachute silk

The Bendix Corporation, $191,836, starter assemblies

The Bendix Corporation, $56,284, carburetor assemblies

Sperry Gyroscope Co., $1,131,260, indicator assemblies

General Electric Co., $878,012, supercharger assemblies

Aviation Manufacturing Corporation, $833,880, airplane engines

Navy

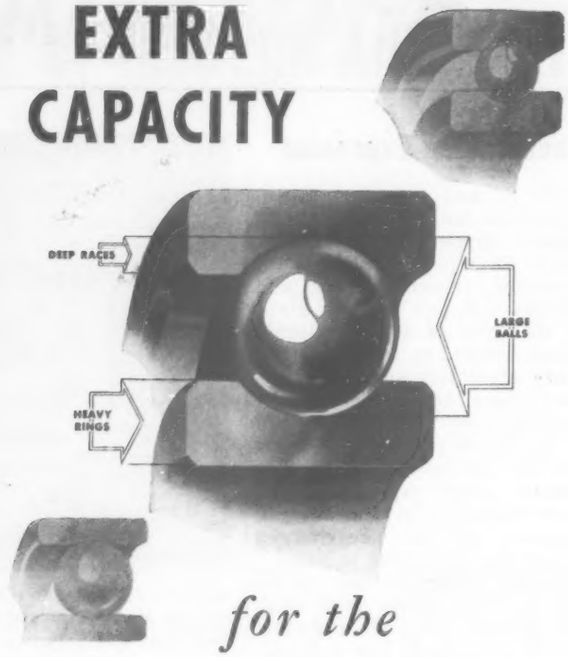
United Aircraft Corp., $10,966.80, blades, propeller

United Aircraft Corp., $14,806.50, propeller assembly; aircraft

Lockheed Aircraft Corp., $117,668.05, airplane

Eclipse Aviation, Div. of Bendix Aviation Corp., $19,778.40, starters, hand and electric inertia; aircraft

EXTRA CAPACITY



for the Heavy-Service Spots

For the engine and accessory applications – heavy service spots of your ships – take advantage of the extra ruggedness, long life and higher radial and thrust capacities of Fafnir's *Balanced Design* in ball bearings.

You'll find the standard bearings for your propeller-thrust, rocker arms and engine accessories in "the most complete line in America." For radical developments requiring special bearings, draw upon Fafnir's 10 years of aircraft specialization.

BALANCE IN DESIGN

Note – unbalanced ring thickness (top illustration) reduces ball size and consequently life and capacity. Unbalanced ball size (lower illustration), ring thickness insufficient to insure strength. (center) FAFNIR BALANCED DESIGN brings race depth, ball size and ring thickness to proper point for maximum performance.

Use the Engineering Catalog No. 35 as a handy reference book for all ball bearing requirements. Your designers will find it invaluable. The Fafnir Bearing Company, Aircraft Division, New Britain, Connecticut.

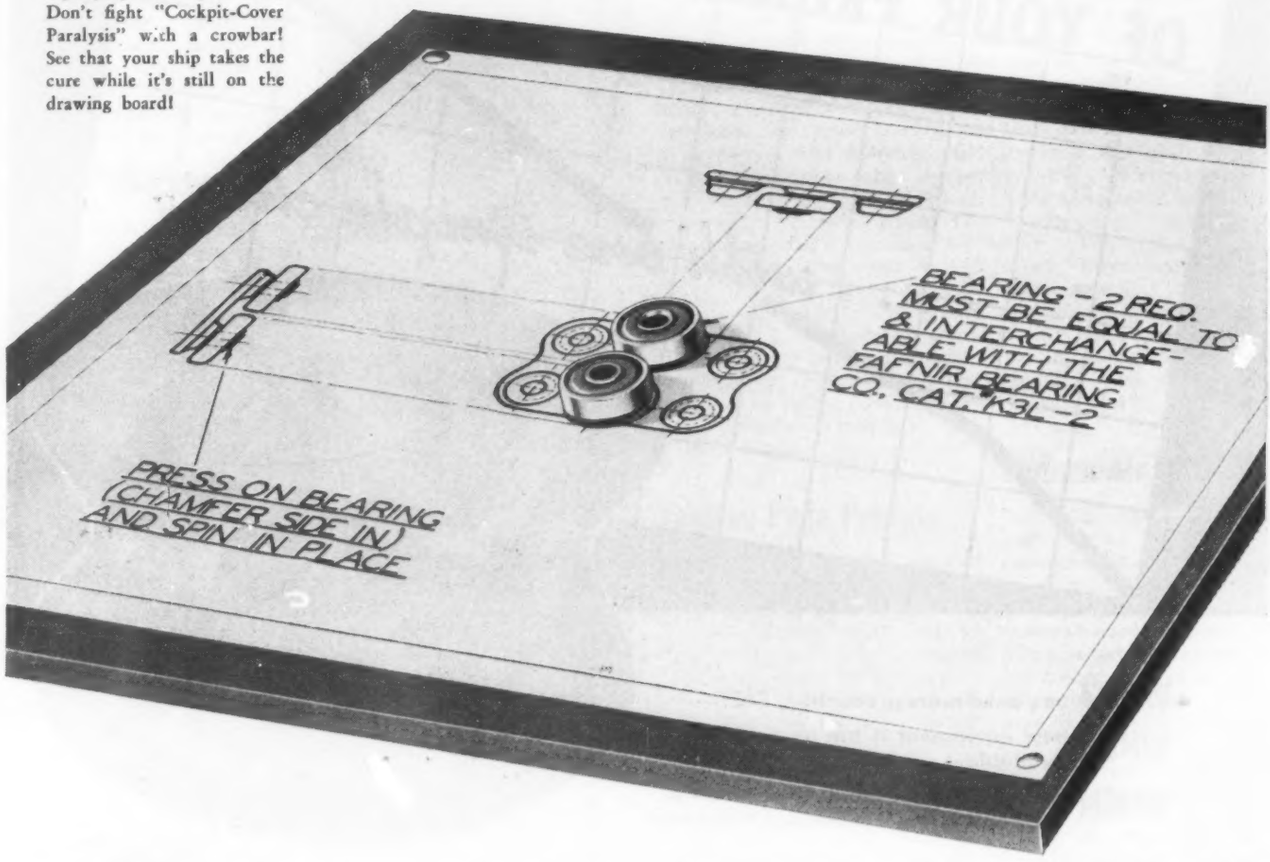
FAFNIR

THE BALANCED LINE . . .

"COCKPIT-COVER PARALYSIS"

Cured on the Drawing Board!

Climbing out at the end of a tiresome cross-country? *Bailing out* as terra firma spins rapidly up toward your nose? Don't fight "Cockpit-Cover Paralysis" with a crowbar! See that your ship takes the cure while it's still on the drawing board!


BEARING - 2 REQ. MUST BE EQUAL TO & INTERCHANGEABLE WITH THE FAFNIR BEARING CO., CAT. K3L-2
PRESS ON BEARING (CHAMFER SIDE IN) AND SPIN IN PLACE

The tremendous quiver of a power-on stall smooths to the rush of a vertical dive . . . to the blurred streak and shrill of full terminal velocity * * * Ease back the stick . . . into the clutch of a 9-*g* pullout! * * * Suppose you had to jump . . . *with a jammed cockpit enclosure above you?*

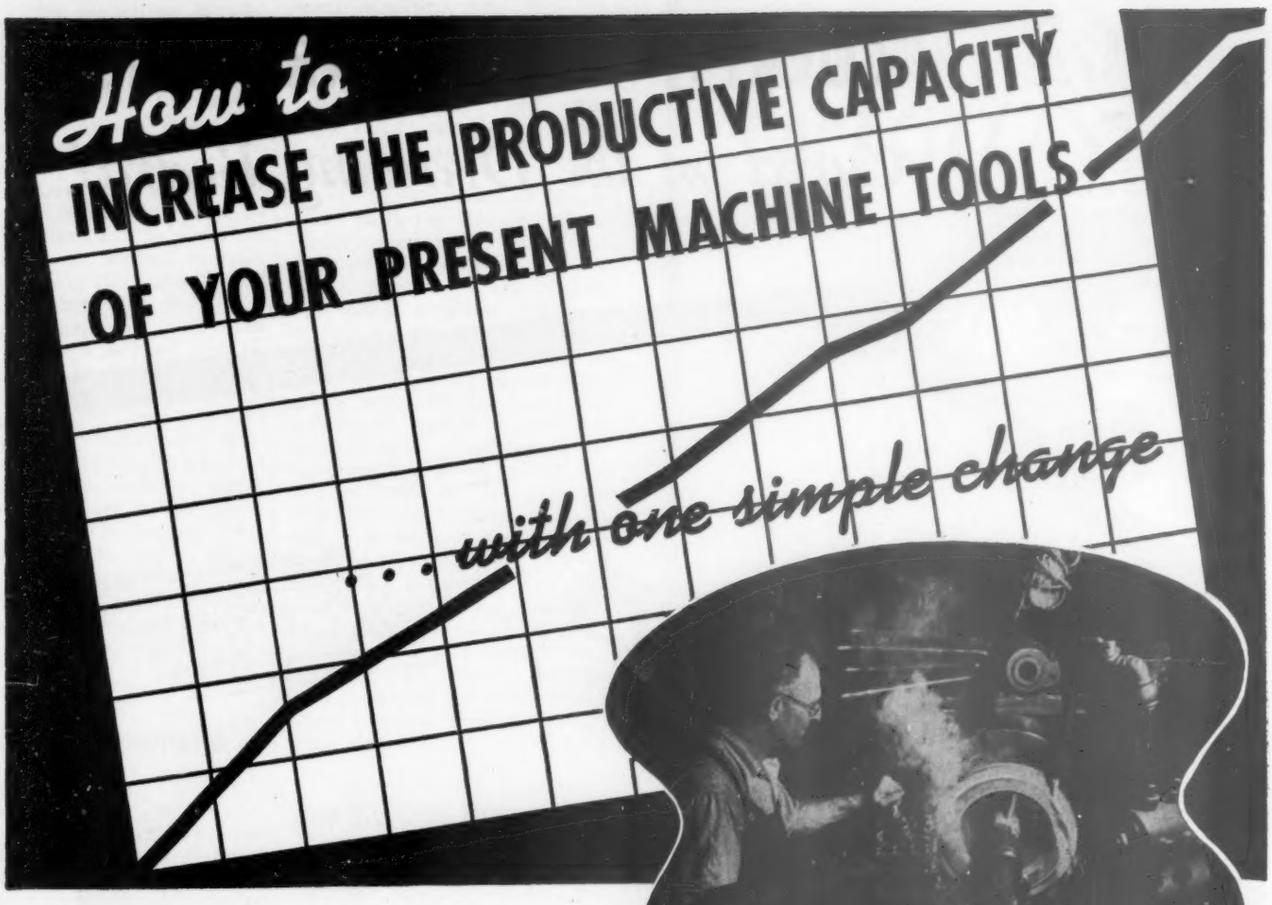
Make no mistake: The wings that win wars will see strains even your test-pilots won't give them! That's why jammed enclosures are lettered out – Fafnir K3L2 Ball Bearings lettered in – on the Vultee tracing above. Even with the fuselage under 9-*g* strain, that cover is eased open at a touch! The Fafnirs it rolls on are not only frictionless but are free from wear, eliminating sloppy covers even after hundreds of hours of service. And they're *integrally sealed*. Dirt stays out. Lubricant stays in.

Ten years of close cooperation with the aircraft industry has produced a *standard* Fafnir for practically any job you can think of, in the widest range of aircraft bearings in America. You will find the assistance of the aircraft bearing specialists valuable in helping to solve your own bearing problems. Write today for Fafnir Aircraft Bearing Catalog and specifications. The Fafnir Bearing Co., New Britain, Conn.

Ball Bearings

MOST COMPLETE IN AMERICA

FOR AIRCRAFT ENGINES AND CONTROLS . . .



PHOTO, COURTESY WARNER & SWASEY CO.

WHEN you need more production, *FAST*—

WHEN new equipment is not immediately available—

WHEN extra man power and extra hours of work fail to meet increased demand—

WHAT WILL BE YOUR ANSWER?

If your plant has this problem to meet—and your production involves machining work—Carboloy tools may provide a means of obtaining an immediate production increase on many of your jobs.

There are two ways in which Carboloy tools can step up production on your present equipment. Reduced cutting time per piece, through higher speeds, is one way. More continuous production per hour—through longer tool life—is the other way. Either, or both, may be the answer in your particular case.

The Mark of CARBOLOY
REG. U.S. PAT. OFF.

Carboloy representatives will be glad to help you get this extra capacity out of your present machines.

✓ Cut Steel with Carboloy. Send for Instruction Bulletin GT-120

CARBOLOY COMPANY, INC., DETROIT, MICHIGAN

CHICAGO • CLEVELAND • NEWARK • PITTSBURGH • PHILADELPHIA • WORCESTER, MASS.

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY CEMENTED CARBIDE TOOLS

AVIATION ENGINEERING

Crash Resistant Belt

Now undergoing service tests is the No. B-12 safety belt—an improved type designed to prevent the pilot from pitching forward. The belt has been under development since Air Corps statisticians noticed a few years ago that crash injuries were mostly in the head and concluded that the lap type safety belt was inadequate.

Two straps, in the new design, are fastened to the buckle of the lap belt, pass over the shoulders, and are fastened at the back of the seat to a coil spring; tension of the spring, and hence degree of freedom of the pilot, is regulated by a lever beside the seat. Whereas the pilot's body jackknifes at a deceleration of 8g with the lap belt, tests show no jackknifing with the new belt up to 15g; it is believed 30g could safely be withstood. The head shows no tendency to jackknife over the body.

Because he weighs exactly 200 lbs., Capt. H. G. Armstrong, the designer, was the victim of a series of drop tests in a seat suspended from a beam.

NEW SAFETY BELT: The new design's chief purpose is to keep the pilot's head from the instrument panel if anything happens.

Automatic CG Computer

Developed especially for use by Howard Hughes in connection with long distance and high-altitude flight testing of the Boeing 307 on which he recently took delivery from the Boeing factory in Seattle, a new Librascope balance computer gives a rapid report of CG location for any possible combination of loading conditions. The instrument, with slight modification, is applicable to the standard Boeing 307 transport. As developed for Hughes the major computations deal with the fuel loads in the various tanks which have been provided in order to give the plane unusual range. The instrument has been designed to show gross load and CG location for various combinations of six fuel tanks having a total capacity of more than 3800 gallons of gasoline.

Standard model Librascopes for CG balance computing are now used on many airlines, primarily with the Lockheed 14 and Douglas DC3 planes, although the instrument can be adapted to any plane. Essential feature of operation is the computation of various load factors, including position of the load, through a foolproof system of lever linkages to direct readings on two dials which show gross load and CG location.

New Interavia A.B.C.

The Third Edition, 1939, of the "Interavia A.B.C.", The International Directory of Aviation has recently been published and is set for distribution in the United States.

A new section has been added to the directory entitled "Atlas" which contains seventy lithographed Aeronautical Maps. The Analytical Index has been revised, which is the key to the book. The book has been written so as to contain information that was unquestionably correct at the time of publication. This information deals with military air forces, aviation industries, commercial airlines, aircraft owners and all other activities associated with aviation for all countries except U.S.S.R., China, Spain, and Slovakia for which no detailed information was available. The book is printed in five languages and is distributed by AVIATION, McGraw-Hill Publishing Co., Inc., sole distributors.

Latest on Rockets

Envisioning rocket speeds approaching 10,000 miles per hour, engineers at California Institute of Technology are conducting extensive rocket motor tests. While Dr. R. H. Goddard, Guggenheim backed rocket research expert, has specialized on flight tests of external design, control mechanism, etc., the Caltech tests are devoted to research with various fuels and types of motors, jets, combustion chambers, etc. In preliminary tests gases have been compressed inside the combustion chamber to a pressure of 2000 lbs. per sq. in., under temperatures reaching 3000 deg. F. It has been calculated that a jet of burning oxygen-ethelene could be expelled from large rocket motors at a speed of 12,000 ft. a second, or more than 120 miles a minute. Theoretical calculations indicate that a 900 pound sounding rocket could be shot some 5,000,000 ft. above the earth, an altitude of about 1000 miles, by building a three-part rocket. The Caltech test program is being conducted by E. S. Forman together with J. W. Parsons.

Handley Page Patents

In the September, 1939, issue of AVIATION there appeared an article concerning the expiring of some patents taken out by Handley Page Limited. Several statements made in this article were evidently in need of correction and we reprint a letter below written by the patent counsel of Handley Page supplying the necessary corrections and clearing up the situation.

"On page 66 of the September, 1939, issue of AVIATION, an article appears under the heading 'Slot Patents Expire' which contains some statements that are in need of correction . . . The 'built-in' or 'fixed' slot, which the article states is now used by Lockheed and is no longer patented, is the earliest form of the Handley Page wing slot. As you say, the patent on it has expired—incidentally, it expired in 1937, not 1939—but that type of slot has long been outmoded by the invention of the much superior Handley Page 'automatic' slot, that is, the slot which is normally closed but which is opened automatically by the air pressure whenever the wing approaches the stall. The patents on the 'automatic' slot still have some years to run.

"The patents which expired in July, 1939, related to still another invention of Handley Page, namely, the slotted flap or slotted aileron, and could hardly be properly described as 'modification-patents held by Handley Page on the orthodox external slot'."

German Air Cameras

Details concerning machines and devices used by foreign governments seem to be hidden in a political haze but from what comes through concerning cameras used to teach German pilots machine gunning they don't seem to be a great deal different in results from those used by our own Air Corps. One type of camera is mounted in the breeze out on the wing, and takes photographs through the front end of its bullet-like shape. On the rear end is a footage indicator indicating the number of feet of film used. The photograph taken has the cross hairs of the gun sight superimposed on the picture as well as a clock and the pilot's name, and looks similar to those taken by U. S. made cameras.

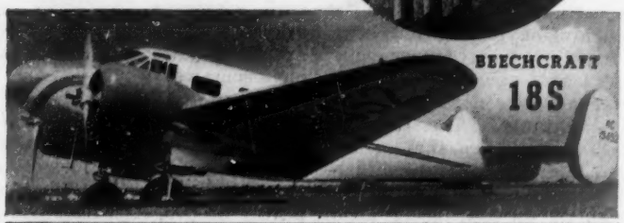
I. P. C.

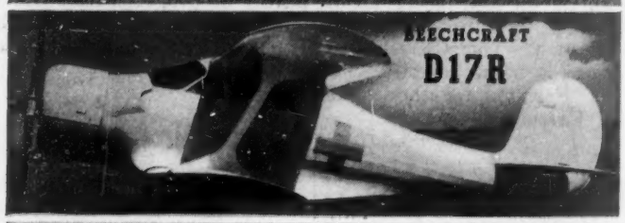
FOR THE GERMAN AIR TRAINING: Machine gun cameras have wing mountings for practice work in Messerschmidt 109's.

U. S. ROYAL FOAM SPONGE

Reduces Flying Fatigue

IN BEECH AIRCRAFT





Photographs by courtesy of Beech Aircraft Corp., Wichita, Kan.

Trade Mark Reg. U. S. Pat. Off.

Here's another way to make passengers "glad they flew instead"...a way to keep pilots at top efficiency for longer periods. For this new foamed latex seat cushioning—U. S. Royal Foam Sponge—*measurably reduces flying fatigue.* It puts a bulwark of quiet restfulness between the body and the three big causes of fatigue.

Its "labyrinth" structure *neutralizes vibration* and *deadens noise.* Each of its millions of tiny connecting pores is an air valve that *absorbs shock.*

And these millions of air cushions support more restfully, too. They "buoy" you . . . make *sitting* feel more like *floating*—effortless—utterly relaxing.

If you make or operate aircraft you'll want to know about these other qualities of Foam Sponge. How it reduces maintenance. How it simplifies construction, saving space and weight. Why it's cooler in warm weather and warmer in cold. Find out now—write to

UNITED STATES RUBBER COMPANY
MISHAWAKA • INDIANA

PROFIT & LOSS

» **American Airlines, Inc.,** for 9 months ending Sept. 30, 1939, net profit of $964,283 after tax provision, compared with profit of $48,691 for the like 1938 period. Total operating revenue for the period was $10,637,097 against $8,112,789 for 1938.

» **Aviation Corporation,** for 9 months ending Aug. 31, 1939, consolidated net loss of $1,324,-047 against net income of $402,-062 or 14c. a share in the same 1938 period. Backlog as of Oct. 18, 1939, $7,250,000, compared with $1,620,000 on May 31, 1939.

» **Bendix Aviation Corporation,** net profit for 9 months of 1939, $3,087,083, after deductions, equal to $1.47 each on 2,097,663 shares of capital stock, compared with net loss of $406,205 for the 1938 period. Dividend of $1 a share was declared.

» **Canadian Colonial Airways,** for quarter ending Sept. 30, 1939, net profit of $37,607 after deductions, but before taxes, compared with net loss of $13,-232 for the 1938 quarter.

» **Curtiss-Wright Corporation** declared a dividend of $1 on Class A stock, payable Dec. 15. Previous payments this year were 50c. each on Oct. 15 and July 15, against only a $1 dividend in 1938.

» **Douglas Aircraft Co.,** for 9 months ending Aug. 31, 1939, net profit of $2,382,159, equal to $3.97 each on 600,000 shares; against net profit of $1,821,964 or $3.19 for same 1938 period. A $3 dividend was declared payable Nov. 20. Backlog as of Nov. 3, 1939, was $75,486,713. All experimental and development expenses incident to production of the DC-4 were completely written off as of Aug. 31, 1939.

» **Eastern Air Lines,** for quarter ending Sept. 30, 1939, net profit of $93,424, equal to 22c. each on 423,618 shares of common stock; against net loss of $10,175 in same 1938 quarter. For the 9 months ending Sept. 30, 1939, net profit of $456,840, equal to $1.08 a share; against $137,588 or 33c. a share for 1938.

» **Fairchild Aviation Corporation,** for 9 months ending Sept. 30, 1939, after taxes, net profit of $295,512, equal to 87c. each on 337,032 shares; compares with $255,402 or 76c. a share in like 1938 period. Unfilled orders as of Sept. 30, 1939, $1,988,361, compared with $1,173,142 as of Sept. 30, 1938.

» **Lycoming Manufacturing Co.,** for quarter ending Aug. 31, 1939, net loss of $71,823, against net loss of $89,445 for quarter ending May 31, 1939.

» **Glenn L. Martin Co.,** for 9 months ending Sept. 30, 1939, net profit of $1,513,778, equal to $1.38 a share. Net sales in the period, $8,566,387. Current backlog, $63,000,000.

» **North American Aviation, Inc.,** declared a dividend a $1, payable Dec. 15th. Previous payment was 40c. on July 12, 1939.

» **Piper Aircraft Corporation,** declared the regular quarterly dividend of 15c. a share on the 60c. No Par Value Preferred Stock, payable Dec. 1, 1939.

» **Pennsylvania-Central Airlines Corp.,** for 10 months ending Oct. 31, 1939, net profit of $89,330 or 36c. per share, after all charges, compared with net profit of $967 for the same 1938 period. The month of October realized a profit of $22,858, after all charges, a 36% increase over October, 1938.

» **The Sperry Corporation** declared a dividend of $1 per share payable Dec. 8, 1939, to Voting Trust Certificate holders.

» **Transcontinental & Western Air, Inc.,** for quarter ending Sept. 30, 1939, net profit of $143,-474 against profit of $8,974 in June quarter, and net loss of $80,668 in September quarter of 1938. For 9 months ending Sept. 30, 1939, loss of $212,393 against a los sof $751,719 for same period in 1938.

» **United Air Lines Transport Corporation,** for month of September, 1939, net profit of $188,765 (revised) against $65,-630 for like 1938 month.

» **United Aircraft Corporation** declared a dividend of $1.25 per share payable Dec. 15, 1939. This, the second dividend paid this year, is the largest United has ever paid.

» **Wright Aeronautical Corporation** ordered a dividend of $2, payable Dec. 14, 1939. Previous payment was $2 on Dec. 14, 1938.

SECURITY

for this "forward march" of American Aviation

To an industry straining under the sudden impact of new production demand, the name WESTON takes on new meaning. It means *more* than precise measurement . . . *more* than the dependable instrumentation which has contributed to flight security since the earliest days of aviation. It means an institution with large and truly modern production facilities...one *fully geared* to meet the instrument demands for this "forward march" of aviation. Thus all branches of this growing industry rest secure in a dependable source of supply for today's as well as for tomorrow's instrument needs. Weston Electrical Instrument Corporation, 616 Frelinghuysen Avenue, Newark, New Jersey.

WESTON
Aircraft Instruments

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CYLINDER TEMPERATURE INDICATORS . ELECTRICAL TACHOMETERS . AMMETERS . VOLTMETERS . VOLT-AMMETERS
BLIND LANDING INDICATORS . . . . RADIO COMPASS INDICATORS . . . . CABIN TEMPERATURE INDICATORS

TRANSPORT AVIATION

Airlines Transition

Developments of the future that may be expected in commercial air transport as outlined by W. A. Patterson, president of United, in addressing the Airlines Club of Chicago:

Airlines are moving away from the single standard of equipment toward three types: (1) long haul, trunk line flights with planes carrying 50 passengers; (2) commuter service between large centers with planes of 21-passenger type; (3) feeder service from small communities with six to 10 passengers.

In coast-to-coast travel it is obvious that four schedules a day will give sufficient frequency. The economics of the pay load and seat capacity thus become determining factors in choice of equipment on trunk lines.

Service must be provided for two classes of travel: (1) through passengers; (2) those enplaning or deplaning at points en route.

Connecting lines are increasing seat capacity owing to increasing travel. Penn-Central and Chicago-Southern are examples. So there is no percentage in trunk lines flying the same type equipment. It is for this reason that United considered DC-4s for coast-to-coast work. Twin-engined sleepers of present type cost 42¢ per mile at 80% capacity. DC4 can be operated at 23 cents at 42% capacity. Patterson said he was disinclined to put much faith in theories of non-stop and one-stop service between coasts. Nothing is gained simply by hauling gasoline. It is necessary to land to pick up and discharge connecting line traffic.

Latest In DC-4's

United Air Lines changed its order for six 60,000-pound Douglas DC-4s to an order for 10 identical models but weighing only 50,000 pounds and costing $340,000 apiece instead of $500,000. Douglas found, after barnstorming the original DC-4, and after inquiry abroad, that there would be more demand for the smaller ship, and that volume would further reduce the production cost. It is understood that other U. S. lines are considering the smaller plane. Its cruising speed is 225 mph as compared with average transport cruising of 180—a big time item on middling to long runs which will importantly affect the standard of air service.

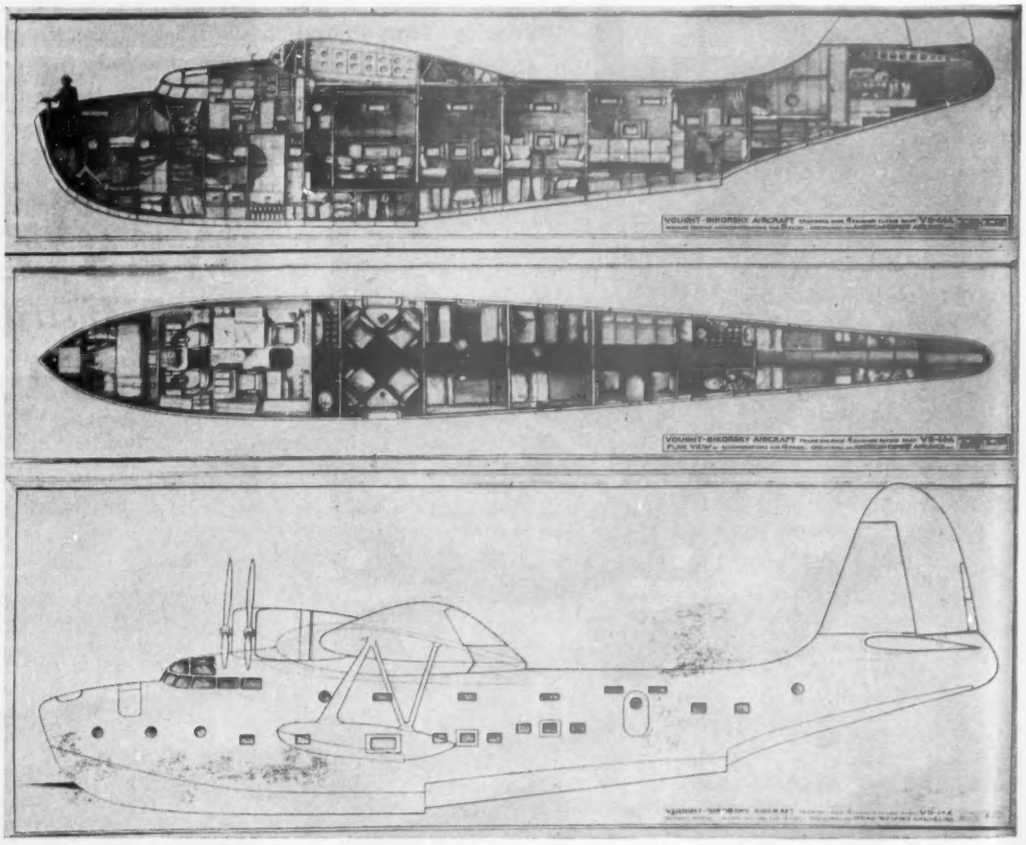
Airline Arbitrators

The creeping paralysis of possible court battles does not appeal to the spirited air transport industry. Under the guidance of Colonel Edgar S. Gorrell, all 15 members of the Air Transport Association have accepted an arbitration agreement for settlement of disputes. Rules will be administered by the American Arbitration Association, the country's star out-of-court conciliator. Typical of trade questions which arbitration boards might be called upon to settle: agreements for mutual use of equipment; questionable advertising practice; standard flight procedure; regulations on non-scheduled flight; maintenance of adequate schedules. This arbitral procedure will not supplant or contravene the Authority of CAA. Study has been going on for two years. Arbiters serve without compensation.

Am. Export—Pan Am.

Application of American Export for a transatlantic route certificate, and Pan American Airways' protest, will force the government to establish a foreign air commerce policy. The civil aeronautics law says that there shall be competition in foreign services, but it doesn't mean anything until more than one airline is actually certificated. Hearings seemed set to continue through November or longer, as this was written. Of course the final decision is up to President Roosevelt, who by law can approve or disapprove the Authority's decision.

Just as hearings were beginning to drone sleepily in the Raleigh Hotel's white-draped spare dining room, Pan American and CAA lawyers fired a startling salvo that rocked Export back on its heels. They told the Authority's examiner that since Export had applied for terminals in France and England, and since the neutrality law forbids operations in those countries, there was no point in going ahead with the hearings. But Export's lawyer was awake, and he said okay, if you stop the hearings you deny us the certificate, and therefore your decision must



ATLANTIC CONTENDER: Out of public testimony during C.A.A. hearings on American Export Air Lines' application comes a preview of the Vought Sikorsky VS-44A. Developed originally for the Navy, the Export version will have sleeping accommodations for 16 passengers and a daylight room for 28. Crew will total 11, including one purser and one steward. Four Pratt & Whitney Twin Wasps (R-18130-S1C3-G) will make 4800 hp. available for takeoff, 4200 as normal ratings. Hamilton Standard Hydromatics (12 ft. 6 in. diameter) will be fitted. The VS-44 has a span of 124 ft., overall length of 79 ft. 3 in. Gross weight is 57,500 lb.—fuel capacity, 3900 gals. Maximum speed is said to be 230 m.p.h.

go to the President for approval. CAA examiner declined to rule and the motion was submitted to the Authority as a whole. CAA's lawyer withdrew his motion to discontinue hearings, and the authority decided to continue. Export meanwhile filed additional applications to operate temporarily to Italy, Portugal, and Spain.

Washington's irrepressible predictors, who are still at it though they score zero consistently on the war, note that the State Department saved out some landing rights in Europe, ostensibly for somebody other than Pan American. It is also said that Roosevelt favors a competitive service. Pan American is supposed to be a little embarrassed, having denied charges of monopoly for years by pointing out that the oceans were free to anybody able to fly them, whereas now company opposes the first newcomer who wants to try.

CAA Reports on San Juan Accident

Apparently lack of telephone communication for landing was a major cause of Pan American Airway's accident at San Juan, Porto Rico last February 19. The Air Safety Board on Nov. 9 sent recommendations to the Authority that PAA be required to install two-way telephone facilities on its South American service. Two-way phone equipment is already in use on PAA's Atlantic and Pacific runs, which operate mostly new equipment. The Latin American equipment carries telegraphic facilities only, and it would seriously increase weight to add the two-way phone. So PAA is developing unit equipment that will handle both voice and telegraph. The Safety Board also recommended that the Authority study PAA's landing procedure relative to operation of engine throttles by the flight mechanic during landings.

All Expense Air Tours

A plan for the sale of "All-Expense Air Tours," which must include at least 20% of surface travel, has been adopted by the Air Traffic Conference of America, composed of all domestic airlines. M. F. Redfern is executive secretary of the conference. A ten per cent commission will be paid to airline agents, provided the 20% ground minimum is met. This plan will enable agents to recover much of the loss they will sustain due to cessation of travel abroad on account of the war. No tour need be preadvertised.

AIR TRANSPORT INDICATOR

November 1, 1939

136.75

Which is the ratio of passenger-miles reported by the Air Transport Association for all domestic lines for October, 1939, to the figure for October, 1938. Trends for the year have continued to fall off but have still managed to keep ahead of last year. For the first 10 months traffic stood at 551,690,659 passenger miles—up 38.9 per cent.

» **United Air Lines** reports a total of 15,950,700 revenue passenger miles for the month of October. This represents an increase of 36.6 over October, 1938.

» **Pennsylvania-Central Airlines** carried 12,083 passengers during October, an increase of 22 per cent over a year ago. This is the sixteenth consecutive month of increase for Penn-Central.

» **Pan American Airways** states that 29,956,461 passenger miles were flown in the third quarter of 1939, which represents an increase of 43 per cent over the same period for 1938.

» **Eastern Air Lines** carried 22,450 revenue passengers in October. This gives an increase of 35 per cent over October of last year.

» **Chicago and Southern Air Lines** flew 936,082 revenue passenger miles during October. This is the best revenue month in the history of the company.

» **American Airlines** logged 22,336,971 revenue passenger miles during October. This is a new world's record for a single month and is an increase of 33.1 per cent over October, 1938.

» **Braniff Airways** flew 2,095,218 revenue passenger miles during October, which represents an increase of 23.47 per cent over October, 1938.

» **TWA** clocked 10,998,431 revenue passenger miles for October. This was the highest month for the company and was 45 per cent over October a year ago.

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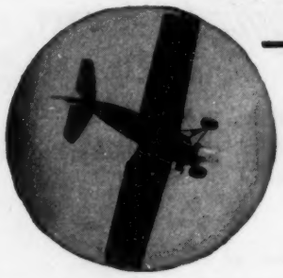
WINTER CLASSES START JAN. 2, 1940



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☐ COMBINATION FLIGHT-MECHANIC

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A. Dec. '39

Roosevelt Aviation School

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AVIATION OPERATORS CORNER

Off To Miami

"When the blazing glory that is Miami's mid-winter sun breaks over its azure Gulf Stream horizon on the morning of January 5, it will mark the birth of a new day in American aviation history—" Yes, by the dawn's early light, that's Claude E. Pullen speaking, president of Miami All-American Air Maneuvers. On that day he expects 1200 airplanes of all types at the municipal airport, more privately-owned airplanes than can be counted in all Europe. On Jan. 5, he expects about 150 additional airplanes in the Bernarr MacFadden race to converge on the Magic City, ladies and gentlemen, from six or more points 1000 miles or more from Florida. Total cash prizes $8,250, and the MacFadden trophy goes to the pilot who makes the best miles-per-hour elapsed time from his starting point. The race is open to planes rated at 150 mph or better; must be radio equipped, no flying over water. Fourteen major events. Elaborate entertainment; myriad night clubs; horse and dog races; "Miss Miami Aviation"; "Miss Orange Bowl." Boy, fetch me my aeroplane!

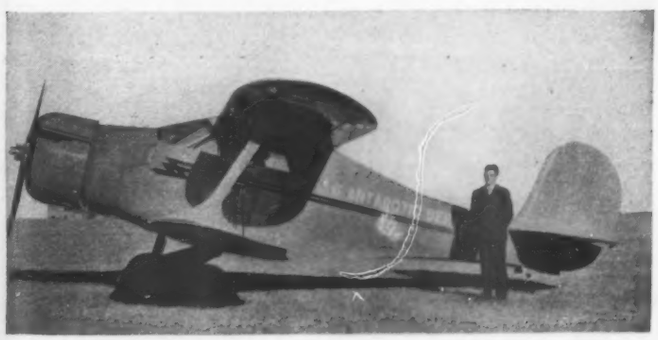
During the month of October there were said to be as many as sixteen lightplane endurance flights under way all at the same time. With so much activity there was bound to be something worthwhile develop, but even the most optimistic hardly anticipated the phenomenal "1000 to 1" performance hung up over Southern California by Clyde Schlieper and Wesley Carroll, flying a Continental 50 powered Piper Cub seaplane. These boys, with very little special preparation in advance, managed to stay in the air for a full month and break all existing endurance flight records with the new figure of exactly 726 hours. Leaving the Long Beach Marine Stadium in their Edo equipped seaplane at 9:09 a. m. Sept. 29th, the fliers set their landing time in advance as one month later. Three o'clock in the afternoon, and on the dot to the minute they landed before a huge crowd in the Long Beach Marine Stadium at exactly 3:09 p.m. October 29th.

The Schlieper-Carroll flight was sponsored by the Kay Jewelry Co. and was organized with the cooperation of Harvey Martin, president of Aircraft Associates, Piper distributor for California and Arizona. Medical examinations showed the pilots to be in perfect shape on landing and the engine actually turned 25 rpm more at the end of the grind than at the beginning, showed excellent operating characteristics, smoothness, and acceleration, and started easily after it had been stopped. An inspection of the plane showed no need of service, other than cleaning. While future plans of the endurance pilots are currently indefinite, it is possible that they will shortly conduct a national "Safety tour" for the Piper organization, visiting Piper dealers as well as various schools and other organizations.

With hundreds of men laboring on its runway and drainage system, and completion still about a year away, the main new east-west runway at Los Angeles Airport will be opened to traffic on Nov. 21, according to announcement of Col. Richard Barnitz, director of airports, city of Los Angeles. Approximately $2,000,000 has already been spent on airport improvements, chiefly the runway and drainage system. A $976,000 municipal bond issue is to be placed before the voters of Los Angeles on Dec. 12th, in an effort to obtain funds for erection of new buildings, provision of lighting facilities, etc. The four major airlines are said to await only completion of the present improvement program before transferring western terminal operations to the municipal field from their present operating headquarters at Burbank.

FROM ROLLING PINS TO MONKEY WRENCHES: The CAA has tried a new one and added a feminine touch to its training program. However the girls aren't excluded from learning something about engines like this Lycoming.

FROM PYLONS TO PILOTS: Roscoe Turner, shown with the trophies he has won, has thrown aside his air racing, and resigned from the Porterfield-Turner Aircraft Corp. to take over the Central Aeronautical Corp, Kansas City, Mo., as a nucleus for a large flying school.



FOR A BYRD'S EYE VIEW: This Beechcraft is what will be carried atop Rear Admiral Byrd's Snow Cruiser for hops around the South Pole. Piloting the plane will be Theodore A. Petras of the Marine Corps (with the plane).

A victory for everyone who flys was won by Ray H. Pignet recently when awarded $25,000 for personal injuries and $1600 for damages to his plane in a suit agains the city of Santa Monica which arose as a result of an accident on Clover Field. In landing his airplane, Pignet collided with an automobile on the runway. As there was no fence around the runway at the time it was the claim of Pignet that the city was negligent.

REPORT CARD
Of Air School

Four new flight instructors and two technical instructors have been added to the staff of the civilian aviation school of the Ryan School of Aeronautics, San Diego, according to announcement of Earl Prudden, general manager. The Ryan School has also added a new auxiliary landing field three miles north of Lindbergh Field adjoining Mission Bay, and providing unobstructed approaches to the 2000 by 2000 ft. landing area which is used for flight training operations of Air Corps cadets. To encourage recreational facilities the school has just completed new volley ball and badminton courts adjoining the student shops. Spacious dormitories have been erected near the field for accommodation of cadets and civilian students.

Established to help meet the current overwhelming demand for men trained for aircraft factory work, and for general field servicing, the Hawthorne School of Aeronautics has been opened in Hawthorne, Calif., by Clifford Pinard, formerly with Boeing, Lockheed, Douglas, Vultee, and North American in various shop capacities, and at one time operator of a flying service and a government approved repair station. The Hawthorne School is specializing in a short mechanic course teaching Army and Navy standards, shop procedures, sheet metal assembly and riveting, use of precision tools, etc.

Automobile industry comes out every year with spring styles, but not aircraft. Instead, airplane manufacturers introduce improvements into current production as soon as they have been tested. That is one of the reasons why almost 100 representatives of manufacturers, airports, Army, Navy, Coast Guard, CAA, and others, have just completed Wright Aeronautical Corporation's third semi-annual lecture course in the servicing and maintenance of aircraft engines and accessories. The lecture series was started last fall. Lectures were given by Wright officials, each a specialist in his field. Enrollment was by invitation. George Chapline, vice president of the company, says that progress has been so rapid during last few years that the course was started to keep workers and executives up to the last technological minute.

Soaring activities continue at a high pitch in the Los Angeles area under the guidance of the Southern California Soaring Association. Both Hawley Bowlus and Wm. G. Briegleb are in production on sailplanes and sailplane kits and are making regular deliveries. Members of the association have been active every week-end at various sites, with Rosamond Dry Lake bed the most popular. Hawley Bowlus has tested his new Super-Albatross cantilever midwing soaring plane with excellent results. New officers of the association, elected at the annual meeting held on Nov. 10th at Aero I. T. I., Glendale, are: Dr. Wolfgang, B. Klemperer, pres; Harvey Stephens, R. A. Bailey, vice presidents; Paul Hepburn, secty-treas.; and the above with: C. L. Bates, Jay Buxton, Charles McReynolds, directors.

Continuing to maintain its claim to title as world's largest civilian operated aviation training school, Curtiss-Wright Technical Institute, Glendale, has more than 900 men currently in training in aeronautical engineering and mechanic courses. According to O. D. McKenzie, Registrar, about 300 are Army Air Corps men receiving mechanic instruction, and the remaining six hundred are civilian students. To handle the continued expansion it has been necessary to take over 35,000 sq. ft. of additional space on Grand Central Air Terminal, converting it into classrooms and shops. Total students at Grand Central Airport, including the Army flight training cadets, now number 1150, according to Major C. C. Moseley, president of Curtiss-Wright Technical Institute.

The American School of Aircraft Instruments, Glendale, Calif., has been purchased by Herbert W. Hartley, long identified with Pacific Coast aviation activities as a sportsman pilot and in other ways. The school was established approximately two years ago by Gene DeBaud to provide specialized training in aircraft instruments and has been successful in building up a strong faculty and student body.

TAGGING THE BASES
with LES NEVILLE

More Civilian Training

CA.A. has taken another praiseworthy step in providing advance training for some of the private pilots created by last year's Civilian Training activities. For a long time we wondered what was to be done with the boys who passed the course last year. Many of them were unable to continue because of lack of funds and it was quite a struggle for most of those who tried to keep up their license requirements. Frankly experimental, the present plan provides for 35 hours of advanced instruction, leading to limited commercial certification, on ships of 125 hp. or more. Fifteen students from each of six of the original 13 colleges are to be selected. This is not only an important and necessary step in strengthening the reserve of civilian pilots the C.A.A. is creating, but it affords the operators a chance to use their higher powered equipment.

Fifty thousand passengers in 26,839 flights, covering 800,000 miles, is a good record for any aircraft. It belongs to the veteran Goodyear blimp "Volunteer" recently de-commissioned at Akron. Successor is to be the new and larger "Resolute" of 123,000 cu. ft. capacity and powered with two 145 hp. Warner engines. The Goodyear blimps have been doing a fine promotion job, both for the company and for aviation in general. Long may it continue.

A lot of live wire salesmen will gather at the foot of Bald Eagle Mountain early in December for Piper's Annual Distributors' Meeting. Here the boys will have a chance to meet each other, swap ideas, iron out territorial squabbles, and offer their ideas to help the company formulate next year's policies. Engine and accessory makers, finance and insurance men, and many others will be there to tell their stories to the distributors. Almost everyone will go home feeling that the other fellow wasn't quite as bad as he thought before they met. This group of distributors has piled up the best private airplane sales record in history, and the Piper Company has stood firmly behind them while they were doing it. Both are to be congratulated on their leadership.

SOMETHING NEW IN DISPLAY: Captain Carl Evers, local distributor for Luscombe airplanes around New York, has opened a new display room on Park Avenue. One of the ships on display has attracted considerable attention from passers-by.

TRAINER

DESIGNED, engineered and built to U.S. Army standards, the new Timm PT-160-K is a two-place, open tandem, military type, primary trainer that introduces the long awaited "plastic era" of aviation.

Formed of triple criss-cross laminated spruce plywood heavily impregnated with phenol formaldehyde, the Timm is resistant to salt water, oil and gasoline and is fire-proof.

Complete absence of exposed rivets or seams means new aerodynamic efficiency. "Moulded manufacture" and a minimum of labor on assembly indicate the first true mass production airplane.

The wing span is 35 feet; overall length is 26 feet, 4 inches; height is 7 feet. Engine installations range from 125 to 220 h.p. Further information and performance data sent on request.

TIMM

TIMM AIRCRAFT CORPORATION, LOS ANGELES METROPOLITAN AIRPORT

New Allison Plant is No Topsy

(*Continued from page 33*)

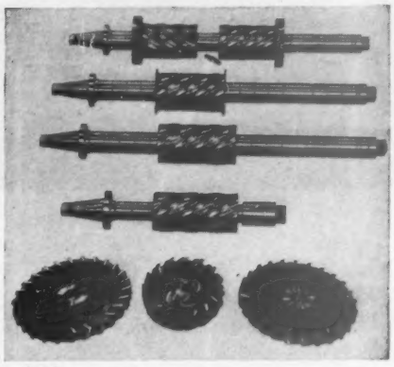
tube with your hand, you see very readily where the energy goes. The tubes throw off only about 1/3 the heat of equivalent mazda wattage and this is another important factor in air conditioning a building whose normal operation generates such a large quantity of heat.

Each of the 40 watt fluorescent tubes are 48 in. long and 1½ in. in diameter, coated internally with fluorescent material and filled with mercury vapor in which an electrical discharge takes place producing light so close to natural daylight that the eye cannot detect the difference.

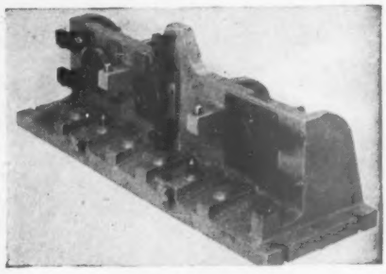
Each tube is housed in a separate aluminum reflector finished by the Alzak process and given a mirror surface of correct contour. There are three tubes in each complete luminaire. Each unit is supplied by a three-phase circuit with each of the individual lamps connected to a separate phase. Thus the stroboscopic effect or cyclic flicker is eliminated entirely for the first time in this, the largest industrial application of its kind. Units are installed on a 12½ ft. x 13 ft. spacing mounted 14 ft. 6 in. above the floor. Average illumination obtained is 28–30 foot candles.

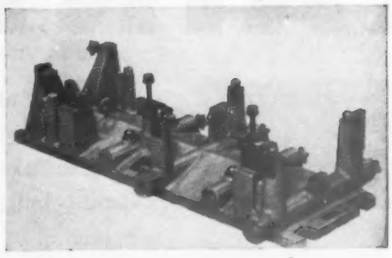
Since engine production doesn't require overhead conveyors the advantages of light roof construction were fully utilized in the building which was designed and constructed under the supervision of the Austin Company. This enabled the designers to reduce the weight of construction below the ground resulting in substantial reductions in building costs. The roof, which is supported on steel columns and welded trusses, is a steel deck with 2 in. of insulation and a 3 ply tar and gravel surface, the clearance to the underside of the trusses being 15 ft. Exterior walls are face brick with a back-up of 8 in. cement block with Indiana limestone coping and interior partitions of cement block excepting those around the heat treating department which are of Haydite block because of its greater insulating value. A 6 in. concrete floor is used throughout. Interior walls, roof beams, and the underside of the roof deck are painted aluminum.

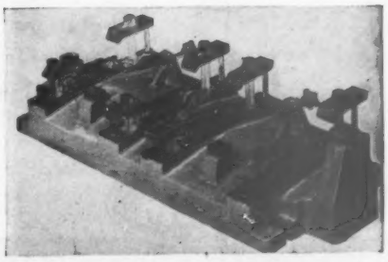
A corridor connects the main building with the test building attached at the southwest corner. The arrangement is such that additional test units may be added as they are required.



Special cutters and fixtures for milling machines.







In the center of the building is a roomy heat treat section, fluorescent lighted and air conditioned and containing a battery of electric furnaces atmospherically controlled. Furnaces and quenching vats are half sunken for waist height operation. A pit beneath the equipment gives easy access for inspection and servicing. The control panel board at one end of the room is visible from any part of the department. The Homocarb and Vapocarb furnaces are all convenient to quench tank and panel board. The Micromax Temperature Difference Control on the Vapocarb furnaces will be used on work that must be hardened with a minimum of distortion. The Homo furnaces are intended for tempering ferrous and non-ferrous materials. A Homo-Nitrider will be used to produce the specially hard case required on nitrided materials.

A complete installation for anodizing, plating, and dicromating as well as equipment for bright cadmium, nickel, copper and chrome plating is included. In the painting department is an explosion-proof automatically controlled bake-oven of the circulating air type having temperature maintained within plus or minus 2½ deg. throughout. A timed conveyor system passes the work through the oven.

To speed up the tooling job, most of the headaches associated with fixtures for machine tool equipment were absorbed in the machine tool builders' plants. The vendors were supplied with the requirements and their contracts called for delivery of machines complete with working fixture equipment. As a result there will be very little adjustment required after installation and that particular job rests squarely on the machine tool builders' shoulders.

Automatic control and hydraulic operation are the dominant features in the equipment. A number of outstanding pieces of equipment are included and some of them are shown in the accompanying photographs.

To relieve the plant of some of its manufacturing load and to develop another source of supply within the General Motors Corp., use has been made of a portion of the capacity and skilled labor of the Cadillac engine plant at Detroit. A portion of the supply of crankshafts, connecting rods and camshafts and their component parts are being turned out there. While it has been found generally impractical to utilize automotive facilities for aircraft engine production because of the differences in materials used and qual-

(*Turn to page 102*)

YOU...

What will Curtiss-Wright Tech training do for you?

The wise investor always determines in advance what the return will be on his investment before he puts cash "on the line". You, who plan to invest in a course of training to prepare you for your future, must do the same. It is even more important to you, since your choice of training will determine how much money you will make all the rest of your life. Curtiss-Wright Tech career training is carefully designed to do just one thing—MAKE MONEY FOR YOU, and for all other Curtiss-Wright Tech graduates.

Our hundreds of successful graduates prove that Curtiss-Wright Tech training gets results and always pays. It has provided them with a profitable occupation and secure future since it trained them in advance for the highest position they could ever expect to occupy. IT CAN DO THE SAME FOR YOU.

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NAME_____ Age____ Date I Plan to Enroll_____

Av-12

ADDRESS_____ City_____ State_____

(*Continued from page 100*)

ity of workmanship, Cadillac was found to be suited for this type of work.

The present plan is to devote the new plant entirely to production and use the very well equipped Unit 2 for experimental and development work. While this shift is in progress, new skilled personnel is being taken on and trained in Unit 2. The experienced workers are being diluted by a number of unskilled men who are assigned to highly detailed operations such as polishing and minor assembly. After 6–8 months they usually acquire sufficient skill to operate one of the simpler machines and from then on their progress is up to themselves. This group is limited by the number of skilled workers available as leaders.

With working conditions as comfortable as they are, the wage scale commensurate with the high skills involved and the prospect of good continuity of employment, Allison is in a position to select the best available personnel which is in keeping with the demands for high quality in this particular variety of manufacturing.

Equipment Suppliers for the Allison Plant

Presses and Cutting Machines

Minster Machine Co.
Peerless Machine Co.
Napier Metal Cutting Band Saw
Andrew C. Campbell Co.
Greenard Arbor Press Co.
Highley Saw

Lathes, Grinders, Shapers, Milling and Broaching Machines

Heald Machine Co., Inc.
American Broach & Machine Co.
Rowbottom Machine Co.
Van Norman Machine Tool Co.
Kent-Owens Machine Co.
Ampco Metal Inc.
Hanson-Whitney Machine Co.
Warner & Swasey Co.
Gisholt Machine Co.
Jones & Lamson Machine Co.
Sundstrand Machine Tool Co.
Cincinnati Milling Machine & Grinder Co.
Gardner Machine Co.
J. G. Blount Co.
Rivett Lathe & Grinders
Hardinge Bros., Inc.
LeBlond Machine Tool Co., R. K.
Monarch Machine Tool Co.
Kearney & Trecker
Geo. Gorton Machine Co.
Fellows Gear Shaper Co.
Hanchett Mfg. Co.
Bryant Chucking Grinder Co.
Foster Machine Co.
Cleveland Automatic Machine Co.
Allen Mfg. Co.
Leland-Gifford Co.
R. G. Haskins Co.
Ingersoll-Rand Co.

Drilling, Boring Polishing and Lapping Machines

Ex-Cell-O Corp.
Giddings & Lewis Machine Tool Co.
Defiance Machine Works
Lucas Machine Tool Co.
W. F. & J. Barnes Co.
Cimatool Co.
Carlton Machine Tool Co.
American Tool Works
Barnes Drill Co.
Avey Drilling Machine Co.
Fosdick Machine Tool Co.
National Automatic Tool Co.
Cincinnati-Bickford Tool Co.
Stud Setting Machines
Pratt & Whitney
Foote-Burt Co.
Edlund Machine Co.
Kingsbury two-spindle drill press
Norton Co.
Adolph I. Buehler

Miscellaneous

Grant Gear Works
Linley Bros.
Magnaflux Machines
Wilson Mechanical Instrument Co.
Vickers, Inc.
Herman C. Holz
Southwark-Tate-Emery
Staley Geared Engine Stands
Browning Tool & Supply
Standard Pressed Steel Co.
Lyon Metal Products
Andale Co.
Elgin National Watch Co.
Hartzell Propeller Co.
Scintilla Magneto, Div. of Bendix Aviation Corp.
United States Gage Co.
Bausch & Lomb Optical Co.
Claude S. Gordon Co.
E. H. Sheldon Co.
Toledo Scale Co.
Fairbanks-Morse Co.
Harold E. Trent Co.
Detroit Rex Products Co.
Pangborn Corp.
Despatch Oven Co.
Fisher Scientific Co.
Leeds & Northrup Co.
A. F. Holden Co.
Lasalco, Inc.

Consolidated

(*Continued from page 46*)

with the net result that at little more than the cost of wood parts the production line is fitted with metal fixtures and jig parts that are every bit as satisfactory as steel for the limited runs produced on them.

As metal has supplanted other materials in airplane construction the machine shop has become the heart of aircraft production. At Consolidated 85 per cent of all machine work is performed in the company's own machine shops. Tool room and production machine shop work more or less interchangeably, the tool room shifting over to production machine work as tooling is completed for a major manufacturing run on a single model. So important is the elimination of lost time between design and delivery that production of a new type is usually started through the machine shop simultaneously with tool and fixture orders that go to the tool shop. As special fixtures and jigs become available they are placed in the production line, but production does not wait on them.

Tool room equipment ranges in size and character from the huge Cleveland planer with 30-ft. bed to the Societe Genevoise (Swiss) jig borer used on precision jig work. Most blanking dies are made on the DoAll Metalmaster from $\frac{1}{4}$ in. crucible steel sheet, with a hardened punch $\frac{1}{4}$th in. thick, at a cost one-third that of the conventional blanking die. It is economical to make such dies for production runs as small as thirty parts. Other special tool room equipment includes a Pratt & Whitney surface grinder, a Fosdick Radial for large jig and fixture work, and the usual battery of lathes, mills, shapers, etc.

Sheet metal shop equipment includes a Cincinnati brake with a 10 ft. throat, which may be extended to 15 ft. by end brackets used in connection with light alloy work; and a Cincinnati shear with a 14 ft. throat, used for trimming and external profiling of large sheet metal blanks. A battery of Niagara punch presses handles a multitude of blanking, forming, drawing, joggling, notching, perforating, nipping, dimpling, crimping, slotting, and burnishing operations, and even some small shear work. In order to get maximum use of the punch presses an ingenious system of dies has been developed, including spring die sets, magnetic die holders, notching and slotting dies held in special die sets, and a fascinating technique in handling joggling dies. Joggling, offsetting, or crimping, is of special importance in joggling or off-setting plate, sheet, or extruded or drawn sections in order properly to assemble certain complex fittings in an aircraft structure. A clever system of joggle dies, using a sliding shoe and return springs, serves to convert the vertical motion of the punch press into a desired transverse and angular motion to achieve the various degrees of joggle required.